meta

the news digest magazine

Volume XXIX-No. 12 December, 1956


# Western Metal Exposition

## PAN-PACIFIC AUDITORIUM
## Los Angeles, California
## MARCH 25 through 29, 1957

## RESERVE YOUR EXHIBIT SPACE NOW!

Metals industries people—ready and able to buy the things they want and need to make things of metal—will be pouring into this great Western Metal Show and you'll want to be there . . . be there with your products on display and your sales staff on its toes, because you'll sell—and sell often—at this great concentration of metals industries people! Remember, more of your customers and prospects will see this Western Show than ever before!


*An activity of the*

**AMERICAN SOCIETY for METALS**

*Write . . . Wire . . . Phone*

7301 Euclid Ave., Cleveland 3, Ohio, Utah 1-0200

Managing Director
W. H. EISENMAN

Assistant Director
CHESTER L. WELLS

# Metals Review

VOLUME XXIX, No. 12 December, 1956

THE NEWS DIGEST MAGAZINE



*Published monthly by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio: D. S. Clark, President; G. M. Young, Vice-President; C. H. Lorig, Treasurer; W. H. Eisenman, Secretary; G. E. Shubrooks, H. A. Wilhelm, G. A. Fisher and Carl E. Swartz, Trustees; A. O. Schaefer, Past President. Subscriptions $5.00 per year ($6.00 foreign). Single copies $1.00. Entered as Second Class Matter, July 26, 1930 at the Post Office at Cleveland, Ohio, under the Act of March 3, 1879.*

*Claims for missing numbers will not be allowed if received more than 60 days from date of issue. No claims allowed from subscribers from overseas, or because of failure to notify the circulation department of a change of address or because copy is "missing from files".*

## CONTENTS



## IMPORTANT LECTURES



## DEPARTMENTS



## ASM REVIEW OF METAL LITERATURE

## *Points Out New Horizons in Metallurgy*

*John H. Hollomon (Right), Manager of the Metallurgy and Ceramics Research Department, General Electric Research Laboratory, Presented a Talk Which Was Entitled "New Horizons in Metallurgy" at a Meeting Held by the Cincinnati Chapter Recently. He is shown with J. F. Kables*

Speaker: J. H. Hollomon
*General Electric Research Lab*

At a recent meeting of the **Cincinnati Chapter** an address entitled "New Horizons in Metallurgy" was presented by J. H. Hollomon, manager of the metallurgy and ceramics research department of the General Electric Research Laboratory.

Dr. Hollomon discussed the future of metallurgy by reviewing the changes that are anticipated in industry, in capital, competition and control.

Automation will lead to increasing capital investment and, with a concurrent decrease in labor costs, will demand more carefully controlled materials.

In the future, competition will be for better materials for better products since the equipment and manufacturing procedures will be similar among competitors.

Increased requirements for superior and uniform properties will necessitate better control of the properties of materials.

As manufacturing becomes more automatic and the investment in equipment becomes larger, the relative contribution of the capital investment to the cost of the product, compared to that of applied labor, will increase. The expense of correcting errors in materials by hand will become greater and the expense of shutdowns that would arise from improper materials will increase. Automatic machinery cannot be sent home when the materials are not right, not for sociological reasons, but because equipment has to be paid for whether it operates or not.

As the need for special materials having special properties becomes greater, the control of the chemistry of the materials, their processing and their properties become more important.

To illustrate the consequence to the future of metallurgy arising from changes in the importance of capital investment, in the methods of competition and in the need for control, Dr. Hollomon selected the aircraft industry and its materials as examples. He illustrated how the temperature of aircraft, in both the frames and the engines, will increase as the speed of the aircraft increases from Mach 1 to Mach 4 during the next 10 years. Typical turbine component temperatures will be of the order of 1000° F. for the skin, 1600° F. for the compressor blades, 2500° F. for the turbine buckets, and 2800° F. for the combustion chamber liner. At present none of the existing materials, such as aluminum, titanium, stainless steels, copper-nickel superalloys, molybdenum alloys or ceramics, fill the bill due to various shortcomings. The aluminum melts, titanium, stainless steels and superalloys have low high-temperature strength, molybdenum alloys oxidize and ceramics are brittle.

The superiority among the several competitors producing jet engines will be determined by the company, or the country, which can develop and utilize improved materials for their aircraft. The difference in performance will depend very much upon the differences of the properties of the materials and the engineering as limited by the properties. Competition in the aircraft field demands an increased attention to materials and their development. Because of their large capital equipment investments the materials must be uniform in properties.

To produce the outstanding properties required for the new applications of aircraft the problem becomes one of controlling the composition, the microstructure and the chemistry so that the most desirable properties can be obtained.

Dr. Hollomon pointed out that the past has seen metals development in which the gross composition has been controlled. The present decade is a period in which the microstructure of the metal is being controlled. The future will require that metals be manufactured so that their atomic arrangements are controlled.

Perhaps, Dr. Hollomon pointed out, the superstrong metals having strengths of millions of pounds per square inch will become the structural materials of tomorrow.—**Reported by John H. Timmers for Cincinnati Chapter.**

---

## Chattanooga Briefed on Aluminum and Its Alloys

Speaker: Harold Y. Hunsicker
*Aluminum Co. of America*

At a meeting of the **Chattanooga Chapter,** a talk on "Aluminum and Aluminum Alloys" was presented by Harold Y. Hunsicker, research metallurgist, Alcoa Research Laboratories, Aluminum Co. of America.

Aluminum has been growing in production every year until now it is the second metal in volume of production and growing more rapidly than steel. From some 750,000 tons in 1950, the production is expected to be around 1,700,000 tons in 1956 and 2,300.000 tons by 1958.

Aluminum, in the shape of foils, building products, windows, store fronts, etc., contributes to this increase. New coloring and decorative methods have added to its attractiveness and appeal in building products. The physical properties of strength, lightness, corrosion resistance, electrical and thermal conductivity, and its nontoxicity, plus its ability to be drawn, stamped, machined and joined by welding, all make aluminum attractive to the designer and engineer.

Using slides to illustrate, Mr. Hunsicker showed the composition and typical uses of various aluminum alloys whose alloying ingredients, such as manganese, magnesium, chromium and silicon, form alloys which are heat treatable by the precipitation hardening process, and have improved physical and mechanical properties for structural applications.

Many of the casting alloys, such as those containing 7% silicon, were illustrated, as well as the special alloys for high temperature where dimensional stabiltiy after heat treatment is important.—**Reported by J. H. McMinn for Chattanooga.**

## *Discusses Superalloys at New York*


*Melvin Metzger, Universal-Cyclops Steel Corp., Is Shown Delivering a Talk on "Superalloys" at a Meeting in New York, as Ludwig Anselmini, Republic Steel; Technical Chairman Ed Ryan, Universal-Cyclops; Kempton Roll, Chapter Chairman; and William Kennelly, Latrobe Steel Corp., Look on*

Speaker: Melvin C. Metzger

*Universal-Cyclops Steel Corp.*

Melvin C. Metzger, technical service metallurgist, Universal-Cyclops Steel Corp., addressed the **New York Chapter** on "Superalloys" recently.

Mr. Metzger explained that superalloys were first introduced for use in the aircraft gas turbine engine just prior to World War II. By the end of the war, about 10 superalloys were in common use; today, more than 100 are available for commercial application.

Superalloys are heat resistant materials which are generally classified as ferritic (martensitic) and austenitic. Both are superior to the AISI-300 series alloys under service conditions for which these alloys are intended. Ferritic superalloys are superior at or above 800° F., while the austenitic class shows superiority at or above 1100° F. Mr. Metzger pointed out the ever-broadening applications for superalloys by including military uses such as rockets, guided missiles and equipment for nuclear power. Peacetime commercial applications include mobile and stationary gas and steam turbines for generating electricity, compressed air and other types of power, exhaust valves for gasoline and diesel engines, boiler tubes and radiant superheater tubes.

Superstrength alloys receive their unique properties from iron, nickel, cobalt or chromium, either singly or in combination, as the basis for their composition. They invariably contain one or more additions of molybdenum, tungsten, aluminum, columbium and titanium to effect strengthening. Strength properties are further dependent upon special processing and/or heat treatment.

The ferritic class of superalloys is used for steam and gas turbine buckets, disks, and bolts for service up to 1200° F. The modified 12% chromiums are highly resistant to stress corrosion cracking, which makes them popular for jet engine axial flow compressor blading.

The austenitic class of superalloys includes those which are hardened by such mechanisms as solid solution hardening, work hardening and multiphase hardening. Most of the superalloys in current use are strengthened by multiphase hardening. Iron, cobalt or nickel-rich base solutions are given high-temperature strength and creep resistance by elements such as tungsten, columbium and titanium which have low solubility in these base solutions.

Most superalloys are presently produced by conventional air-arc and air-induction melting methods. Newer techniques include vacuum processes which give closer composition control and virtual elimination of inclusions or impurities. Improvements in mechanical properties also result, and it is easier to melt the more highly reactive elements like titanium and aluminum. The newer techniques include arc or induction melting followed by consumable electrode vacuum melting, and induction vacuum melting followed by consumable electrode vacuum melting. Generally, vacuum melting improves both strength and ductility.

Molybdenum and its alloys are the most promising of the so-called refractory group of materials. Produced by the arc cast and powder metallurgy methods, molybdenum begins to show its superiority above 1600° F., where the strength of many superalloys begins to decline. Molybdenum and its alloys possess mechanical properties largely dependent upon fabrication history, particularly in the amount of working done below the recrystallization temperature. Above 1200° F., molybdenum oxidizes at a catastrophic rate, and elevated temperature protection is being investigated in the form of ceramic coating, electroplating, cladding and siliconizing. Present superalloy turbine bucket operational temperatures could be raised 300 to 400° F. if adequately protected molybdenum were utilized.

A distinct departure from cast and forged superalloys are the cermets. These are refractory compounds combined with metals and are fabricated by powder metallurgy methods. Titanium carbide-type cermets contain 50 to 90% titanium carbide. Nickel cobalt and chromium, used alone or together, are added as binders in amounts of 10 to 50%. Thermal and strength properties are affected by the type and amount of metal binder, with alloy binders giving higher strength values than pure metal binders. Cermets have good oxidation resistance and high strengths at 1700° F. and above, but display limited ductility below 1600° F.

Ceramics are made up of refractory oxides, carbides, borides, nitrides, silicides and sulphides. They have higher strengths and superior oxidation resistance above 2000° F. than superalloys and most cermets. However, they have the disadvantages of being quite brittle and having low resistance to thermal shock.

Mr. Metzger concluded by explaining a more recent development for improving upon the mechanical properties and fabrication techniques of such highly reactive refractory materials as molybdenum, zirconium and columbium. This is to be accomplished by processing (rolling, forging, etc.) in an enclosed facility filled with inert gas, such as argon or helium, and operated by men wearing "space suits" with externally supplied breathing apparatus. The operation has been aptly termed "closed circuit fabrication" or "in-fab", and offers an interesting challenge to the metals industry.—**Reported by V. E. Adler for New York.**

## Metals and Atomic Power Discussed at Notre Dame

Speaker: E. C. Miller

*Oak Ridge National Laboratory*

Members of the **Notre Dame Chapter** heard Edward C. Miller, inspection engineer, Union Carbide Nuclear Co. at the Oak Ridge National Laboratory, talk on "Metals and Atomic Power".

Laying the foundation for his talk with a short resume of the theory, development and present status of atomic power, Mr. Miller proceeded to present examples of both the usual and unique demands made on metals in a nuclear reactor. These included their applications as structural members, shields, moderators and fuels. The talk was well illustrated with slides giving the rating and suitability of various materials for these different applications.

Mr. Miller concluded by relating some problems of fabricating a small power reactor.—**Reported by R. C. Pocock for Notre Dame.**

## *Points Out New Horizons in Metallurgy*

*John H. Hollomon (Right), Manager of the Metallurgy and Ceramics Research Department, General Electric Research Laboratory, Presented a Talk Which Was Entitled "New Horizons in Metallurgy" at a Meeting Held by the Cincinnati Chapter Recently. He is shown with J. F. Kables*

Speaker: J. H. Hollomon
*General Electric Research Lab*

At a recent meeting of the **Cincinnati Chapter** an address entitled "New Horizons in Metallurgy" was presented by J. H. Hollomon, manager of the metallurgy and ceramics research department of the General Electric Research Laboratory.

Dr. Hollomon discussed the future of metallurgy by reviewing the changes that are anticipated in industry, in capital, competition and control.

Automation will lead to increasing capital investment and, with a concurrent decrease in labor costs, will demand more carefully controlled materials.

In the future, competition will be for better materials for better products since the equipment and manufacturing procedures will be similar among competitors.

Increased requirements for superior and uniform properties will necessitate better control of the properties of materials.

As manufacturing becomes more automatic and the investment in equipment becomes larger, the relative contribution of the capital investment to the cost of the product, compared to that of applied labor, will increase. The expense of correcting errors in materials by hand will become greater and the expense of shutdowns that would arise from improper materials will increase. Automatic machinery cannot be sent home when the materials are not right, not for sociological reasons, but because equipment has to be paid for whether it operates or not.

As the need for special materials having special properties becomes greater, the control of the chemistry of the materials, their processing and their properties become more important.

To illustrate the consequence to the future of metallurgy arising from changes in the importance of capital investment, in the methods of competition and in the need for control, Dr. Hollomon selected the aircraft industry and its materials as examples. He illustrated how the temperature of aircraft, in both the frames and the engines, will increase as the speed of the aircraft increases from Mach 1 to Mach 4 during the next 10 years. Typical turbine component temperatures will be of the order of 1000° F. for the skin, 1600° F. for the compressor blades, 2500° F. for the turbine buckets, and 2800° F. for the combustion chamber liner. At present none of the existing materials, such as aluminum, titanium, stainless steels, copper-nickel superalloys, molybdenum alloys or ceramics, fill the bill due to various shortcomings. The aluminum melts, titanium, stainless steels and superalloys have low high-temperature strength, molybdenum alloys oxidize and ceramics are brittle.

The superiority among the several competitors producing jet engines will be determined by the company, or the country, which can develop and utilize improved materials for their aircraft. The difference in performance will depend very much upon the differences of the properties of the materials and the engineering as limited by the properties. Competition in the aircraft field demands an increased attention to materials and their development. Because of their large capital equipment investments the materials must be uniform in properties.

To produce the outstanding properties required for the new applications of aircraft the problem becomes one of controlling the composition, the microstructure and the chemistry so that the most desirable properties can be obtained.

Dr. Hollomon pointed out that the past has seen metals development in which the gross composition has been controlled. The present decade is a period in which the microstructure of the metal is being controlled. The future will require that metals be manufactured so that their atomic arrangements are controlled.

Perhaps, Dr. Hollomon pointed out, the superstrong metals having strengths of millions of pounds per square inch will become the structural materials of tomorrow.—**Reported by John H. Timmers for Cincinnati Chapter.**

## Chattanooga Briefed on Aluminum and Its Alloys

Speaker: Harold Y. Hunsicker
*Aluminum Co. of America*

At a meeting of the **Chattanooga Chapter,** a talk on "Aluminum and Aluminum Alloys" was presented by Harold Y. Hunsicker, research metallurgist, Alcoa Research Laboratories, Aluminum Co. of America.

Aluminum has been growing in production every year until now it is the second metal in volume of production and growing more rapidly than steel. From some 750,000 tons in 1950, the production is expected to be around 1,700,000 tons in 1956 and 2,300.000 tons by 1958.

Aluminum, in the shape of foils, building products, windows, store fronts, etc., contributes to this increase. New coloring and decorative methods have added to its attractiveness and appeal in building products. The physical properties of strength, lightness, corrosion resistance, electrical and thermal conductivity, and its nontoxicity, plus its ability to be drawn, stamped, machined and joined by welding, all make aluminum attractive to the designer and engineer.

Using slides to illustrate, Mr. Hunsicker showed the composition and typical uses of various aluminum alloys whose alloying ingredients, such as manganese, magnesium, chromium and silicon, form alloys which are heat treatable by the precipitation hardening process, and have improved physical and mechanical properties for structural applications.

Many of the casting alloys, such as those containing 7% silicon, were illustrated, as well as the special alloys for high temperature where dimensional stabiltiy after heat treatment is important.—**Reported by J. H. McMinn for Chattanooga.**

## *Discusses Superalloys at New York*


*Melvin Metzger, Universal-Cyclops Steel Corp., Is Shown Delivering a Talk on "Superalloys" at a Meeting in New York, as Ludwig Anselmini, Republic Steel; Technical Chairman Ed Ryan, Universal-Cyclops; Kempton Roll, Chapter Chairman; and William Kennelly, Latrobe Steel Corp., Look on*

Speaker: Melvin C. Metzger
*Universal-Cyclops Steel Corp.*

Melvin C. Metzger, technical service metallurgist, Universal-Cyclops Steel Corp., addressed the **New York Chapter** on "Superalloys" recently.

Mr. Metzger explained that superalloys were first introduced for use in the aircraft gas turbine engine just prior to World War II. By the end of the war, about 10 superalloys were in common use; today, more than 100 are available for commercial application.

Superalloys are heat resistant materials which are generally classified as ferritic (martensitic) and austenitic. Both are superior to the AISI-300 series alloys under service conditions for which these alloys are intended. Ferritic superalloys are superior at or above 800° F., while the austenitic class shows superiority at or above 1100° F. Mr. Metzger pointed out the ever-broadening applications for superalloys by including military uses such as rockets, guided missiles and equipment for nuclear power. Peacetime commercial applications include mobile and stationary gas and steam turbines for generating electricity, compressed air and other types of power, exhaust valves for gasoline and diesel engines, boiler tubes and radiant superheater tubes.

Superstrength alloys receive their unique properties from iron, nickel, cobalt or chromium, either singly or in combination, as the basis for their composition. They invariably contain one or more additions of molybdenum, tungsten, aluminum, columbium and titanium to effect strengthening. Strength properties are further dependent upon special processing and/or heat treatment.

The ferritic class of superalloys is used for steam and gas turbine buckets, disks, and bolts for service up to 1200° F. The modified 12% chromiums are highly resistant to stress corrosion cracking, which makes them popular for jet engine axial flow compressor blading.

The austenitic class of superalloys includes those which are hardened by such mechanisms as solid solution hardening, work hardening and multiphase hardening. Most of the superalloys in current use are strengthened by multiphase hardening. Iron, cobalt or nickel-rich base solutions are given high-temperature strength and creep resistance by elements such as tungsten, columbium and titanium which have low solubility in these base solutions.

Most superalloys are presently produced by conventional air-arc and air-induction melting methods. Newer techniques include vacuum processes which give closer composition control and virtual elimination of inclusions or impurities. Improvements in mechanical properties also result, and it is easier to melt the more highly reactive elements like titanium and aluminum. The newer techniques include arc or induction melting followed by consumable electrode vacuum melting, and induction vacuum melting followed by consumable electrode vacuum melting. Generally, vacuum melting improves both strength and ductility.

Molybdenum and its alloys are the most promising of the so-called refractory group of materials. Produced by the arc cast and powder metallurgy methods, molybdenum begins to show its superiority above 1600° F., where the strength of many superalloys begins to decline. Molybdenum and its alloys possess mechanical properties largely dependent upon fabrication history, particularly in the amount of working done below the recrystallization temperature. Above 1200° F., molybdenum oxidizes at a catastrophic rate, and elevated temperature protection is being investigated in the form of ceramic coating, electroplating, cladding and siliconizing. Present superalloy turbine bucket operational temperatures could be raised 300 to 400° F. if adequately protected molybdenum were utilized.

A distinct departure from cast and forged superalloys are the cermets. These are refractory compounds combined with metals and are fabricated by powder metallurgy methods. Titanium carbide-type cermets contain 50 to 90% titanium carbide. Nickel cobalt and chromium, used alone or together, are added as binders in amounts of 10 to 50%. Thermal and strength properties are affected by the type and amount of metal binder, with alloy binders giving higher strength values than pure metal binders. Cermets have good oxidation resistance and high strengths at 1700° F. and above, but display limited ductility below 1600° F.

Ceramics are made up of refractory oxides, carbides, borides, nitrides, silicides and sulphides. They have higher strengths and superior oxidation resistance above 2000° F. than superalloys and most cermets. However, they have the disadvantages of being quite brittle and having low resistance to thermal shock.

Mr. Metzger concluded by explaining a more recent development for improving upon the mechanical properties and fabrication techniques of such highly reactive refractory materials as molybdenum, zirconium and columbium. This is to be accomplished by processing (rolling, forging, etc.) in an enclosed facility filled with inert gas, such as argon or helium, and operated by men wearing "space suits" with externally supplied breathing apparatus. The operation has been aptly termed "closed circuit fabrication" or "in-fab", and offers an interesting challenge to the metals industry.—**Reported by V. E. Adler for New York.**

## Metals and Atomic Power Discussed at Notre Dame

Speaker: E. C. Miller
*Oak Ridge National Laboratory*

Members of the **Notre Dame Chapter** heard Edward C. Miller, inspection engineer, Union Carbide Nuclear Co. at the Oak Ridge National Laboratory, talk on "Metals and Atomic Power".

Laying the foundation for his talk with a short resume of the theory, development and present status of atomic power, Mr. Miller proceeded to present examples of both the usual and unique demands made on metals in a nuclear reactor. These included their applications as structural members, shields, moderators and fuels. The talk was well illustrated with slides giving the rating and suitability of various materials for these different applications.

Mr. Miller concluded by relating some problems of fabricating a small power reactor.—**Reported by R. C. Pocock for Notre Dame.**

## New Films

### Cobalt in the Katanga

A 35-min. color film, Cobalt in the Katanga, tells the story of cobalt production in the Belgian Congo from mining through concentrating, refining and finally reduction to the elemental metal in the form of rondelles, granules or powder. It was produced by the Cobalt Information Center, Battelle Memorial Institute, under the auspices of the Union Miniere du Haut-Katanga. The Cobalt Information Center will provide the film and an accompanying speaker without charge for education, research, technical and industrial groups requesting it.

### Aluminum on the March

The story of aluminum, from the mile-high bauxite mines of Jamaica to the mile-long rolling mills of the midwest, is told in a new Eastman Color documentary presented by Reynolds Metals Co. The 28-min. production utilizes spectacular special effects and stop-motion photography as well as location photography to chronicle an industry that contributes to everyday living and national defense in many and varied applications.

Prints may be borrowed from the regional film exchanges of Association Films in Ridgefield, N.J., La Grange, Ill., San Francisco, Calif., and Dallas, Tex.

### Engineering for Eddy

The type of training necessary for the engineering profession and the engineer's role in planning the world of tomorrow are subjects of this nontechnical color movie released by the College of Engineering, Ohio State University.

The 20-min. film is designed to serve as a guide to today's youngsters and their parents in evaluating the educational requirements and practical applications of engineering training. The film answers the questions: What is an engineer? Why is he needed? What does he need to know? How does he become an engineer?

The film is available through the Department of Photography, Motion Picture Division, Ohio State University, Columbus 10, Ohio.

**A.S.M. created the Annual Teaching Award in Metallurgy, open to teachers of metallurgy in the United States and Canada. Value $2000.**

## Clark Presents 25-Year Certificate

*Donald S. Clark (Left), National President A.S.M., Is Shown Presenting a 25-Year Membership Certificate to Verle H. Erickson, Manager, Harris Metal Treating Co., at a Meeting Held Recently by the Milwaukee Chapter*

## Techniques of Metal Fabrication Outlined For Atlanta Chapter

Speaker: W. C. Pattillo
*Southern Saw Service, Inc.*

The **Atlanta Chapter** featured a talk by W. C. Pattillo, plant manager of Southern Saw Service, Inc., at its initial meeting this season. He discussed "Metal Fabrication Techniques" used in the production of tools for the meat-cutting industry.

Steel strip, of carbon percentage near 1.00% and a Rockwell hardness of approximately 52C, is formed into blades for band and handsaws for cutting meat. The band saw strip has dimensions in the range 0.020 to 0.025 in. thickness and a width of 5/8 or 21/32 in. The hand saws use a narrower strip. Teeth are punched at a rate of 800 per min. and the strip is automatically cut to desired lengths. The strips are then resistance welded and the joint annealed by a special automatic welder developed for this purpose. In addition to automatically controlling proper tooth spacing at the joint, this welder has proved to be an excellent quality inspector for steel, as bend tests quickly detect steel containing undesirable inclusions.

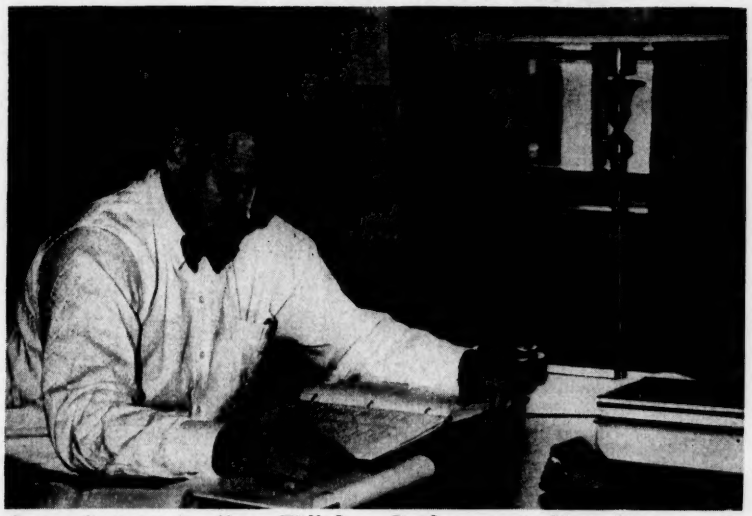
The blades are sharpened and set by an ingenious mechanical system, each blade being filed automatically during two complete revolutions. They are then inspected for set and sharpness by a highly skilled blind worker who has developed a phenomenal sense of touch.

Plates and blades for meat shredders are also fabricated. The plates are made from Type-440 stainless steel and vary in size from 2¾ to 8⅝ in. in diameter, with from a few to 2406 holes. Before hardening the holes are drilled by hand using a template for the pattern. The blades are brazed to cast steel rotors. Both plates and blades are finished by precision grinding techniques.

A unique development of the Southern Saw Service has been a meat comb consisting of a cast 356 aluminum alloy frame supporting 196 No. 420 stainless steel fingers perforated at the end in contact with the meat. These fingers, set in staggered rows, comb the bone dust from the meat as it is cut by the bandsaw. The meat is thus of more marketable appearance. The combs have proved highly satisfactory in actual performance and have been purchased by a number of supermarkets of nationwide distributors.

The Southern Saw Service, under the capable leadership of its president, E. A. Anderson, a charter member of the Atlanta Chapter, has supported a research program of several years duration at the Georgia Institute of Technology. The company's products are continually undergoing study for improvement in alloy selection and fabrication techniques. The progressive attitude of the company and its success in the ingenious solution of many mass-production metal-fabrication problems is indicated by the thriving state of its business in the meat-cutting industry. — **Reported by James Johnson for Atlanta.**

# *M. E. I. Courses Available Soon*



*Scenes Such as the Above Will Soon Be Common in Many Homes as the M.E.I. Correspondence Courses Become Available to Metallurgical Personnel Who Wish to Continue Their Education While Holding Down a Full-Time Job*

"Open for business Jan. 1, 1957" is the watchword of the A.S.M. Metals Engineering Institute, as the first four of its series of 40 home study courses are being rushed through printing. The trail-blazing texts are No. 1, "Elements of Metallurgy", edited by Ralph Edelman, chief of the Reactive Metals Division, Pitman-Dunn Laboratories, Frankford Arsenal; No. 10, "Heat Treatment of Steel" by George Melloy of Bethlehem Steel Co.; No. 16, "High-Temperature Metals" by C. L. Clark of Timken Roller Bearing Co.; and No. 27, "Titanium", edited by Walter Finlay, vice-president, Rem-Cru Titanium, Inc.

Five more courses are promising contenders for early 1957 availability, according to Anton deS. Brasunas, M.E.I. director. These are "Stainless Steels", "Steel Foundry Practice", "Electroplating and Metal Finishing", "Primary and Secondary Recovery of Lead and Zinc", and "Oxy-Acetylene Process". M.E.I. staff expediters include Hans Heine, formerly technical director, A.F.S., and G. X. Diamond.

Designed primarily for self-education by the correspondence method, the M.E.I. courses will also be used for in-plant training programs and A.S.M. chapter educational series. They have been created in response to the urgent need for technically trained personnel in the metallurgical industry, and nationwide interest in their potential for progress has been growing ever since the first announcement of the project by A.S.M. national secretary, William H. Eisenman.

Information regarding the courses can be obtained by writing to the Metals Engineering Institute, 7301 Euclid Ave., Cleveland 3, Ohio.

## Discusses Titanium and Its Alloys at Penn State

### Speaker: E. F. Erbin

***Titanium Metals Corp. of America***

"Titanium and Its Alloys" was the subject of a talk by E. F. Erbin, metallurgical engineer, Production Development Division, Titanium Metals Corp. of America, at a meeting of the **Penn State Chapter.**

Mr. Erbin discussed the process and physical metallurgy, the applications and the economics of this relatively new metal.

Titanium has been known to exist since 1770, but it has been only in the last few years that commercial methods have been developed for separation and purification of the metal. Production has jumped from a mere eight tons in 1949 to an estimated 25,000 tons in 1957. The high price of titanium is gradually decreasing with increase of production.

The high cost of this metal is the result of necessarily complicated methods of extraction and refining. To utilize the desirable properties of titanium, it is necessary to minimize the presence of such gases as oxygen, nitrogen and especially hydrogen. These elements increase the brittleness to a point where titanium cannot be used under high stress.

Oxygen, nitrogen and hydrogen contents are held to a minimum by melting the sponge, and then remelting the ingot under reduced pressure in the consumable electrode process, and subsequent heat treatments under a protective oxidizing atmosphere.

Useful alloys have been made with magnesium, chromium, iron, vanadium, molybdenum and aluminum. Aluminum has been found to be the most useful in gaining desired high-temperature properties.

The properties of titanium, which include low density, strength up to 1000° F., and corrosion resistance, have favored its extensive use in jet aircraft and guided missiles.

Mr. Erbin concluded his talk by reviewing the history and current status of titanium alloy development and areas of investigation which might lead to improvement of the high-temperature properties of titanium.—**Reported by Donald Toland for Penn State Chapter.**

## *Technical Papers Invited for A.S.M. Transactions*

The Transactions Committee of the A.S.M. is now receiving technical papers for consideration for publication in the 1958 Transactions and possible presentation before the next national meeting of the Society to be held in Chicago, Nov. 4 to 8, 1957.

Many of the papers approved by the Committee will be scheduled for presentation on the technical program of the 39th National Metal Congress and Exposition and the 2nd World Metallurgical Congress.

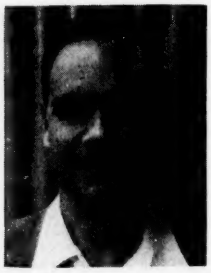
Papers may be submitted any time up to Apr. 15, 1957, for consideration for presentation at this convention. The selection of approved papers for the convention technical program will be made early in May 1957. Manuscripts may be submitted any time during the year and upon acceptance by the Transactions Committee will be processed immediately for preprinting. All papers accepted will be preprinted and made available to any members of the Society requesting them. However, the printing of an accepted paper does not necessarily infer that it will be presented at the convention. Under a new plan of the Society, preprinting of accepted papers will be done quarterly. Notification of their availability will be published in *Metals Review.*

Manuscripts in triplicate, plus one set of unmounted photographs and original tracings, should be sent to the attention of Ray T. Bayless, assistant secretary, American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

Should it be your intention to submit a paper, please notify A.S.M. A copy of the booklet entitled "Suggestions to Authors in the Preparation of Technical Papers" will be gladly forwarded. This booklet may help considerably in the preparation of line drawings and illustrations.

# Meet Your Chapter Chairman

*D. R. Edgerton*



*J. C. White*

*J. P. Bates*

### CHICAGO

DAVID R. EDGERTON, sales metallurgist, Lindberg Steel Treating Co., was born in Philadelphia. He was originally trained as a mechanical engineer at Haverford College near Philadelphia. He soon became interested in toolmaking and tool hardening, and has been engaged for the past 25 years in the study of the practical metallurgy of heat treating with the Carpenter Steel Co., Dayton Forging and Heat Treating Co., and for the past 15 years as metallurgist and sales metallurgist with Lindberg. His broad practical experience and numerous articles and papers have qualified him as a leading authority on heat treating problems and their solution.

Mr. Edgerton and his wife, Blanche, have a son, David, Jr., and a daughter, Jane. His hobby is gardening.

### OREGON

JAMES P. BATES was born in Boston, Mass., and received his primary schooling in Hyde Park, Dedham and Ipswich, Mass. He graduated from Washington State with a B.S. degree in metallurgy and worked for Westinghouse Electric Corp. before becoming associated with the Hyster Co., where he now holds the position of chief metallurgist.

Jim has a 12-year old daughter. He is a member of Toastmasters International and served his chapter A.S.M. in various capacities before becoming chairman.

### CAROLINAS

ALBERT B. COOPER, sales engineer, Edgcomb Steel Co., is a native of Clearwater, Fla. He graduated with a B.S. degree from Duke University where he was active in football and track. He is married and has two children. Al served as treasurer and vice-chairman of the Carolinas Chapter before being elected to his present office. He claims golf is his only hobby at the present time.

### OLD SOUTH

JAMES C. WHITE, manager of the J. C. White & Co., was born in Gadsden, Ala., and graduated with a degree in chemical engineering from the University of Alabama. He has done heat treating and inspection work, and served with the U.S. Navy on amphibian duty in the South Pacific. He and his wife, Bettye, have four children, Tom, Ann, John and Steve. He served his chapter as program committeeman in 1955.

### SAN DIEGO

L. J. HULL was born in Deadwood, S. Dak., and graduated from the South Dakota School of Mines with a B.S. degree in metallurgical engineering. He participated in intramural sports at school.

He started work as control metallurgist for Aluminum Co. of America and has done intermediate work on powder metallurgy and material and guided missile projects. He is now employed as chief metallurgist at Ryan Aeronautical Co.

Mr. Hull was senior author for the article on Cemented Carbides in the 1948 edition of the Metals Handbook.

He is married and has a 8-year old son. He is past chairman and an active member of the Toastmasters Club, and claims fishing and photography are his hobbies.

### DAYTON

LOUIS W. MCBRIDE, chairman of the Dayton Chapter, has been prominent in A.S.M. activities for about 15 years. For the past six years he has served in various executive committee appointments and progressed through the offices of treasurer, vice-chairman to his present office of chairman. His guidance and effort have helped to establish outstanding technical programs and an over-all expansion of general A.S.M. activities.

Mr. McBride is chief metallurgist of the Aeroproducts-Allison Division, General Motors Corp. Prior to his association with General Motors he served as a chemist with the Norge Corp. He attended Arkansas State College, where he graduated with a B.S. degree in chemistry and he also attended the University of Michigan graduate school.

Mr. McBride is married and has two children. He is a member of Rotary and Kiwanis and has aided in various community projects. His hobby is photography.

### EASTERN NEW YORK

HAROLD F. OSTER, vice-president, Geier & Bluhm, Inc., was born in Lackawanna, N. Y. He received his degree in chemical engineering from Rensselaer Polytechnic Institute and started work with Republic Steel Corp. in the metallurgy department. Later he became chief metallurgist for Republic Aviation Corp. in Farmingdale, N. Y.

Mr. Oster and his wife, Marion, have three children, Carol, Russell and David. He has been active in the YMCA, Industrial Club, Troy Chamber of Commerce and has held responsible positions in the work of his church. Mr. Oster has served the Eastern New York Chapter as a member of the awards committee, the educational committee, the executive committee and as program chairman.

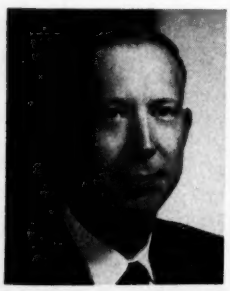
He holds a private pilot's license and is actively interested in fishing and stamp collecting.

### BRITISH COLUMBIA

JAMES P. MCCULLOCH, chief metallurgist, Canadian Sumner Iron Works Ltd., was born in Vancouver and attended the University of British Columbia, where he majored in metallurgical engineering. During the war he served on the British Columbia War Metals Research Board. He has also worked as a foundry superintendent.

Jim is married and has one boy. He is a member of the American Foundrymen's Society and the Steel Founders' Society of America. His hobbies are hunting, baseball, gold, fishing and golf.

*H. F. Oster*



*L. W. McBride*

*J. P. McCulloch*

# CHAPTER MEETING CALENDAR

| CHAPTER | DATE | PLACE | SPEAKER | SUBJECT |
|---|---|---|---|---|
| Akron | Jan. 16 | Sanginiti's | Social | Ladies Night |
| Albuquerque | Jan. 28 | University of New Mexico | Conference With Los Alamos Chapter | Heat Tolerant Metals for Aerodynamic Applications |
| Atlanta | Jan. 7 | Atlantic Steel Co. | | Aluminum in the Aircraft Industry |
| Baltimore | Jan. 21 | Engineers Club | R. R. Hartwell | Material Requirements of Tin Cans |
| Birmingham | Jan. 8 | Holiday Inn | Social | Ladies Night |
| Boston | Jan. 4 | M.I.T. Faculty Club | H. H. Uhlig | Corrosion |
| Buffalo | Jan. 10 | Red Coach Inn | J. J. Harwood | Stress Corrosion |
| Calumet | Jan. 8 | Phil Smidt | G. F. Sullivan | What's Ahead for Metal Workers? |
| Canton-Massillon | Jan. 22 | Mergus Restaurant | Social | Ladies Night |
| Carolinas | Jan. 17 | Winston-Salem | A. Korbelak | Developments in Precious Metal Plating |
| Chattanooga | Jan. 15 | Maypole Restaurant | W. S. Pellini | Significance of Notch Ductility Tests |
| Chicago | Jan. 14 | Northwestern University | J. H. Hollomon | Materials and the Future |
| Chicago-Western | Jan. 21 | Spinning Wheel | J. Gurski | Economics in Materials Selection |
| Cincinnati | Jan. 10 | Engineering Society | R. J. Severson | Copper Alloys for the Occasional Metallurgist |
| Cleveland | Jan. 7 | Hotel Hollenden | | Zay Jeffries Night |
| Columbus | Jan. 2 | Battelle Institute | E. S. Rowland | Practical Applications of Physical Metallurgy |
| Dayton | Jan. 9 | | W. Kemper | Machinability of Stainless Steels |
| Detroit | Jan. 14 | Rackham Memorial | A. L. Boegehold | Materials for the Automobile of the Future |
| Indianapolis | Jan. 21 | Brody's Village Inn | K. F. Schauwecker | Practical Aspects of Quenching |
| Kansas City | Jan. 16 | | K. L. Fetters | Steelmaking, Research and Production |
| Lehigh Valley | Jan. 4 | Hotel Trayler | J. S. Vanick | Alloy Cast Irons |
| Los Alamos | Jan. 28 | University of New Mexico | Conference With Albuquerque Chapter | Heat Tolerant Metals for Aerodynamic Applications |
| Louisville | Jan. 8 | White Cottage | H. A. Wilhelm | Metallurgy in Atomic Energy |
| Mahoning Valley | Jan. 8 | V.F.W., Youngstown | L. R. Berner | Openhearth Night |
| Milwaukee | Jan. 15 | | F. W. Boulger | Metallurgical Aspects of Machinability |
| Montreal | Jan. 7 | Queen's Hotel | R. G. Sultan | Flame Plating and Its Applications |
| Muncie | Jan. 8 | Ball State College | H. H. Hausner | Cermets—Principles and Latest Developments |
| New Haven | Jan. 17 | Waverly Inn | K. A. Matticks | Stainless Steels |
| New Jersey | Jan. 21 | Essex House | F. M. Richmond | Some Vacuum Melted Alloys |
| New Orleans | Jan. 9 | Lenfant's Seafood Restaurant | C. Donoho | Metallurgy of Steel Castings |
| New York | Jan. 14 | Hotel Victoria | James Wilson | Mechanical Testing of High-Temperature and Radioactive Metals |
| Notre Dame | Jan. 9 | Nabicht Bros. Restaurant | T. W. Lippert | Current Developments in Titanium Alloys |
| Oak Ridge | Jan. 16 | K. of C. Hall | R. V. Meghreblian | Application of Metallurgical Properties to Engineering Design |
| Ontario | Jan. 4 | Hamilton | K. L. Fetters | Steelmaking, Production and Research |
| Penn State | Jan. 8 | Mineral Sciences Auditorium | Dan Krause | Gray Iron Foundry and Some of Its Problems |
| Peoria | Jan. 14 | American Legion Hall | P. R. Wray | New Tools for Selection of Engineering Steels |
| Philadelphia | Jan. 25 | Engineers Club | F. H. Vandenburgh | Titanium, the Metal With Engineering Properties and Promising Potentialities |
| Philadelphia-Jr. Section | Jan. 14 | Engineers Club | E. A. Fleming | Toolsteel |
| Phoenix | Jan. 15 | | H. Stark | Electric Arc Machining |
| Pittsburgh | Jan. 10 | Gateway Plaza | J. R. Willard | Developments in the Aluminum Industry |
| Purdue | Jan. 15 | Memorial Union | | Management and Sustaining Members Night |
| Rhode Island | Jan. 2 | Johnson's Hummock Grill | Julius Ferrari | Developments in Close Tolerance Casting |
| Rockford | Jan. 23 | Faust Hotel | R. P. Seelig | Diffusing Chromium Into Metal Surfaces |
| Rocky Mt.-Denver | Jan. 18 | Oxford Hotel | W. L. Grube | Electron Metallography |
| St. Louis | Jan. 18 | Hotel Congress | W. Jones | Vacuum Melting |
| Savannah River | Jan. 10 | Tinnerman's Lodge | H. L. Maxwell | Engineers and Jobs—Adapting One to the Other |
| Springfield | Jan. 21 | Armory | H. P. Langston | Metallurgy of Small Arms Weapons |
| Texas | Jan. 8 | Ben Milam | Social | Ladies Night |
| Tri-City | Jan. 8 | Rock Island Arsenal | C. L. Faust | Surface Protection of Metals |
| Washington | Jan. 14 | | W. G. Pfann | Zone Melting |
| West Michigan | Jan. 21 | Lock's Restaurant | H. Gomberg | Nuclear Engineering |
| Western Ontario | Jan. 18 | Windsor | A. O. Schaefer | Forging Industry |
| Worcester | Jan. 9 | Hickory House | E. Bancroft | Toolsteel Salt Bath Hardening |
| York | Jan. 9 | York | P. Rossin | Pilot Plant Research |

## *Describes U.S.S. T-I Alloy Steels*

*Shown at a Meeting of the Columbia Basin Chapter Are, From Left: J. W. Goffard, Treasurer; Norman R. Hart, Columbia Geneva Division, U. S. Steel Corp., and Karl Schauwecker, U. S. Steel Corp., Guest Speaker of the Evening*

Speaker: Karl Schauwecker
*U. S. Steel Corp.*

At a recent meeting of the **Columbia Basin Chapter,** Karl Schauwecker, U. S. Steel Corp., spoke on "U.S.S. T-1 Constructional Alloy Steels". Subdividing his discussion into three sections, Mr. Schauwecker described the development of this new steel, its metallurgical characteristics, and its constructional applications.

The new T-1 steel is a type of low-carbon complex alloy exhibiting a high strength level, 90,000 psi. minimum yield strength, coupled with good toughness and weldability. These desirable properties depend upon the development of a tempered martensitic structure produced by a water quench from 1650° F. and tempering at 1200° F. There is no tendency toward quench cracking.

Welding can be performed using recommended procedure to produce welds having 100% joint efficiency. Even without stress relief and at subzero temperatures, toughness in the weld area is still adequate. Recommended practices for weldments requiring stress relief regularly develop efficiencies of 90% or better.

As a result of a very intensive testing and development program, U.S.S. T-1 steel was accepted in 1955 as suitable for construction of A.S.M.E. coded pressure vessels.—**Reported by I. D. Thomas for Columbia Basin Chapter.**

## *Receives Lehigh's Stoughton Award*

*John Y. Riedel, Toolsteel Engineer, Bethlehem Steel Co., Was the Thirteenth Recipient of the Lehigh Valley Chapter Bradley Stoughton Award. This award was established by the Chapter in 1944 to recognize its members for outstanding contributions to metallurgy. Mr. Riedel (left) is shown receiving the award from Carl B. Post, the chairman of the Chapter*

## *Compliments*

To LAWRENCE M. KUSHNER, who has been selected to head the newly organized Metal Physics Section of the National Bureau of Standards Metallurgy Division. The Bureau's metallurgy program is directed toward a better understanding of the properties and behavior of metals so that new or improved metals and alloys may be developed for better performance in established uses to meet the requirements of new applications.

♦ ♦ ♦

To EDWARD DYBLE, chairman of the Cleveland Chapter, who has joined Bardel, Inc., as a consulting engineer and a member of the sales staff. Mr. Dyble was formerly chief metallurgist of Cleveland Diesel Engine Division of General Motors Corp.

♦ ♦ ♦

To HERBERT HOLLOMON, General Electric Research Laboratory, who has been named advisory editor for a new "Series on the Science and Technology of Materials" to be published by John Wiley & Sons, Inc. Dr. Hollomon is the author of a wide variety of technical publications and in 1955 was named by the U.S. Junior Chamber of Commerce as one of America's "ten outstanding young men of the year". He has served since its founding as secretary-treasurer of *Acta Metallurgica.*

♦ ♦ ♦

To STEPHEN K. TARBY, LOUIS D. KIRKBRIDE and GERALD LIEDL, who have been awarded fellowships supported by Jones & Laughlin Steel Corp.'s Aid to Education Plan for the current academic year. Mr. Tarby holds the fellowship at Carnegie Institute of Technology, Mr. Kirkbride continues his work toward a doctorate in metallurgy at C.I.T., and Mr. Liedl is continuing his education at Purdue.

♦ ♦ ♦

To ROBERT LINDLEY ZIEGFELD, who was presented with a testimonial resolution by the Metal Powder Association in honor of the fact that he had served as its secretary and treasurer for nine years until its establishment as an independent organization.

## Kansas City Members Hear Talk on Atmosphere Control

Speaker: Robert F. Day
*Leeds & Northrup Co.*

Robert F. Day, market development section, Leeds & Northrup Co., presented a talk on "Instrumentation and Control of Atmosphere and Temperature" in **Kansas City.**

Mr. Day's talk included diagrams and an explanation of the principles of thermocouples and circuits and steam atmosphere blueing to increase life of cutting tools.—**Reported by Lowell M. Noblet for Kansas City.**

## ASM-MEI Conference on Titanium Set for March

Titanium experts and persons interested in obtaining answers to various production problems associated with titanium fabrication will gather at the Ambassador Hotel in Los Angeles during the week of the Western Metal Congress, Mar. 25-29, 1957, when the A.S.M. Metals Engineering Institute is sponsoring the Titanium Conference, with emphasis on practical production problems.

The Titanium Conference will bring together persons who want answers and others who have some solutions. The program of speakers includes users, fabricators and producers of titanium who will encourage cross-examination of unsolved practical problems and production "know-how" by research-minded engineers to produce a lively five-day session.

To make the conference manageable, attendance will be restricted to approximately 100 registrants on a first come, first served basis. Preliminary registrations have already assured conference planners that a sell-out is in the making. The registration fee has been set at $125, which will also cover daily lunches and study materials. Study materials include reprints or abstracts of the talks to be presented at the conference, reprints of the titanium papers presented at the 1956 National Metal Congress, and the new 15-lesson home study course on titanium currently being prepared by the Metals Engineering Institute.

The tentative program of the Titanium Conference is as follows:

**Monday, Mar. 25**

APPLICATIONS, DESIGN, AND CLEANING

Why Titanium Is Used
Today's Uses and Design Problems
- In Piloted Airframes
- In Missiles
- In Jet Engines
- In Army and Navy Applications
- In Civilian Applications

Titanium Fasteners
Stress Relief, Annealing, and Reactions With Atmosphere
Pickling, Degreasing and Abrasive Cleaning
Salt Bath Descaling

**Tuesday, Mar. 26**

FORMING

Blanking and Sheet Metal Forming
Forming of Extrusions and Bars
Forming of Tubular Stock
Panel on Forming

**Wednesday, Mar. 27**

MACHINING

Milling and Contour Cutting
Drilling and Tapping
Single Point Cutting
Grinding
Chemmilling
Panel on Machining

**Thursday, Mar. 28**

WELDING AND BRAZING

Arc Welding Titanium
Resistance Welding
Brazing and Soldering

**Friday, Mar. 29**

A LOOK INTO THE FUTURE

Economics of Using Titanium
Influence of Inpurities
Sources, Tolerances, and Effects
Present Limitations and Future Possibilities of Titanium Castings
Present Limitations and Future Possibilities of Titanium Powder Metallurgy
Present Limitations and Future Possibilities of Titanium Forgings
Panel on Research in Progress

## Talks in Akron on the Plastic Flow of Metals

Speaker: E. V. Crane
*E. W. Bliss Co.*

The first regular monthly meeting of the **Akron Chapter** featured a talk by E. V. Crane, research director of the E. W. Bliss Co., on the "Plastic Flow of Metals in Various Typical Metalworking Operations". Mr. Crane put particular emphasis on the cold extrusion of steel, which is the most severe of the metalworking operations.

In addition to the technical speaker, Paul E. Belcher, vice-president, First National Bank of Akron, presented a talk on what effect the St. Lawrence Seaway will have on the Akron area.—**Reported by M. Goldman for Akron.**

## *Metal Coatings Topic at Oak Ridge*

*Richard B. Belser (Left), Associate Professor at the Georgia Institute of Technology, Spoke on "Oxidation Resistant Coatings and Metal Coating Techniques" at a Meeting in Oak Ridge. He is shown with John Cathcart*

Speaker: R. B. Belser
*Georgia Institute of Technology*

Richard B. Belser, associate professor, Georgia Institute of Technology, addressed the members of the **Oak Ridge Chapter** on "Oxidation Resistant Coatings and Metal Coating Techniques".

Mr. Belser pointed out that known materials for use at high temperature are subject to corrosion, brittleness and scarcity. Of these factors, corrosion appears most amenable to solution.

One solution would be the development of protective coatings for molybdenum which would allow its use at temperatures below which creep does not become a factor. An alternate solution would be the development of a new material—alloy, compound, ceramic or cermet — that would not be subject to corrosion, brittleness or scarcity.

Mr. Belser illustrated with slides several methods of coating that have been considered, and discussed the pros and cons of each method.

He concluded that sputtering techniques yielded porous films, vapor pyrolysis gave, in general, brittle films, and dipping and cementation techniques require materials, temperatures and facilities difficult to obtain and control. Spray techniques appear to hold the most promise, according to the speaker.

A number of flame spray techniques have been developed, but care must be taken to protect against porosity in films. An arc spray method has been developed to lessen porosity and is undergoing tests at the present time.—**Reported by A. Goldman for Oak Ridge Chapter.**

## *Warren Members Tour Tube Plant*

*John J. B. Rutherford, Chief Metallurgist of the Babcock & Wilcox Tubular Products Division Plant, Explains a Dilatometer, an Apparatus Used for Measuring Thermal Expansion Characteristics, to Members of the Warren Chapter Who Toured the Plant Recently. From left are: Jose Carmino; A. E. Bizzari; Howard Blair, vice-chairman; Eugene Heffner, chairman; and Mr. Rutherford. (Photograph courtesy of Babcock & Wilcox Co.)*

## Denver Chapter Members See Film and Hear Talk on Wire and Rail Production

Speakers: John Zadra and H. N. Dorward

*Colorado Fuel & Iron Corp.*

A dramatic motion picture, "Indian Paint", was shown at a meeting held by the **Rocky Mountain Chapter** in Denver. The picture was produced by the Colorado Fuel and Iron Corp. to illustrate the modern technology of an integrated steel operation and provided a vivid portrayal of the processes involved in the production of rails and wire rope from raw materials to finished products.

A brief historical introduction depicted the time, not very long ago, when Indians mixed hematite ore from Sunrise Mountain in Wyoming with bear grease for the production of ceremonial paints. In vast contrast is the present day utilization of the iron ore body, which is the largest deposit west of Mesabi. The picture illustrated how modern processing methods transport hugh tonnages to Pueblo, Colo., which is conveniently located with respect to coke, limestone and fluorspar sources. The steelmaking operation was colorfully described with excellent photographic scenes of the blast furnace and openhearth operations, the soaking pits and the various mill processes. The picture concluded with a detailed illustration of the fabrication methods and quality control procedures which are utilized in the manufacture of rails, tie-plates, joint bars, bolts, spikes and wire cables.

John Zadra, assistant superintendent of quality control, and H. N. Dorward, manager of the Rocky Mountain Division, Wire and Rope Division, Colorado Fuel & Iron Corp., answered questions and presented comments at the conclusion of the movie.

Mr. Zadra exhibited a series of slides showing the evolution of rail shapes down to the present and illustrating the various types of rail failures encountered in service. He indicated that the average mainline rail is guaranteed for a period of five years, but can usually be expected to provide service for from 12 to 15 years.

Although many types of rail failures, such as transverse fissures produced by hydrogen flaking or piped rails caused by insufficient cropping of the ingot, have been largely curtailed by close quality control, research and improvement is continuing for the purpose of anticipating the heavier demands which will be made on the rails of the future. For example, mild alloy steel rails in a heat treated condition are currently being tested in service to see if Shelly-type cracks can be eliminated. Shelly cracks are fatigue failures produced at track curves as the result of very high imposed shear stress. The potentialities of welded rail joints are also being investigated. **—Reported by Frank C. Perkins for Rocky Mountain-Denver.**

## Speaks on T-1 Steel at Meeting in Vancouver

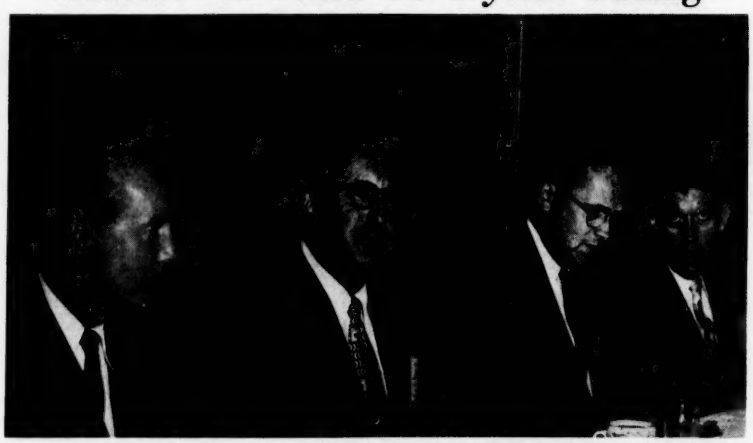
Speaker: K. Schauwecker

*U. S. Steel Corp.*

K. Schauwecker, United States Steel Corp., spoke on "New Constructional Steel—T-1" in **Vancouver.**

Mr. Schauwecker presented a most interesting discussion of the constructional steel designated as T-1. His talk was accompanied by slides which graphically illustrated the points he was making. He also showed a short color movie on the production and testing of T-1 steel, and at the conclusion of his talk, he answered many questions put to him by the audience.—**Reported by M. F. Gray for Vancouver.**

## *Members in Tulsa Go Crystal Gazing*



*Kenneth E. Rose, Professor of Metallurgical Engineering, University of Kansas, Presented a Talk on "Crystal Gazing" at a Meeting Held by the Tulsa Chapter. Mr. Rose demonstrated crystal formations, solid phase changes and some of the properties of metals as related to crystal structure. From left are: F. A. Dewey, secretary-treasurer; W. L. Smith, program chairman; Mr. Rose; and G. R. Clay, chairman. (Reported by A. N. Stevens)*

# Metallurgical News and Developments

*Devoted to News in the Metals Field of Special Interest to Students and Others*

A Department of *Metals Review*, published by the
American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

**Crucible Acquires Interest**—Crucible Steel Co. of America has acquired the entire interests of National Research Corp. in Vacuum Metals Corp., which now becomes a wholly owned Crucible subsidiary. Vacuum Metals was the first commercial producer of high-vacuum cast metals and alloys.

**Visible Strains**—X-ray investigations of silicon single crystals show them to be so nearly perfect that strains due to individual dislocations in the lattice should be detectable. W. L. Bond, Bell Telephone Labs, has succeeded in detecting these strains by using photo-elastic techniques. While opaque to visible light, silicon is transparent in the near infrared, and its measured photo-elastic constants are large enough so that strains of one part in a million are detected readily.

**New Paint**—Galvafroid, a British cold galvanizing paint, is being offered for manufacture in the U. S. It can be brushed on metallic surfaces even when moist with complete assurance of protection against rust. It is produced by Secomastic Ltd.

**Wins Award**—Bridgeport Brass Co. was judged as having the best annual report of the copper products industry for the ninth consecutive year in the final rating by an independent board of judges in the 16th annual survey of *Financial World*, national weekly magazine.

**Conference**—The American Power Conference, sponsored by Illinois Institute of Technology in cooperation with 14 universities and 9 technical societies, will be held at Hotel Sherman, Chicago, Mar. 27 to 29, 1957. The conference will provide a forum for discussion of problems and exchange of information concerning the electric power industry and associated activities.

**Germanium Rectifier**—An air-cooled germanium plating rectifier, incorporating automatic voltage stabilization and remote stepless reactor control, has been announced by General Electric's rectifier department.

**Solar Energy**—The Association for Applied Solar Energy, in conjunction with Stanford Research Institute, Arizona State College at Tempe, and the University of Arizona, will sponsor a two-day symposium on solar furnace design and operation in Phoenix, Jan. 21 and 22, 1957. It is being organized to bring industry and governmental agencies the latest information on the part solar furnaces will be playing in the study of materials at very high temperatures.

**Rhenium Program**—A two-year research program on the use of rhenium in electron tubes has been initiated at Battelle Memorial Institute, under sponsorship of the Air Force Research Center, Cambridge, Mass. The program was designed to provide fundamental information about rhenium for the electron-tube industry, and to establish the extent to which rhenium may be used to advantage as an electron-tube construction material.

**New Plant**—U. S. Industrial Chemicals Co., Division of National Distillers Products Corp., will put into operation a 10,000,000-lb. per year plant for the production of high-quality titanium sponge by the end of 1957. The step will make U.S.I. the first company to enter the titanium field without a government procurement guarantee.

**Metal Forming Machines**—A new family of high-speed automatic metal forming machines, expected to raise the production of body trim, roof sections, and other components for modern passenger cars by better than 200%, has been developed by Cyril Bath Co., in collaboration with engineers at the Chrysler Corp.

**Enriched Uranium**—The world's first production by private industry of enriched uranium for use in generating commerical electrical power from atomic energy has been started at Mallinckrodt Chemical Works' new plant at Hematite, Mo.

**To Build Lab** —Mellon Institute has announced plans for the construction of a $1-million laboratory to house its recently established department of radiation research.

**Rolling Mill**—A rolling mill made by Stanat Manufacturing Co. for Argonne National Laboratory will hot roll plutonium, uranium, etc., under a helium atmosphere −0.15 to −1.5 in. of water. To contain this atmosphere and to protect personnel from radiation most of the mill is covered with a ½-in. CR 39 clear allyl polymer. Access to parts of the mill for adjustment and roll changes is made through synthetic-gloved porthole areas. The mill cost $50,000, plus $15,000 for electrical controls, and rolls the metals to 0.003 in. It also rolls shapes.

**Lithium Institute**—Establishment of the American Lithium Institute, Inc. has been announced by American Potash and Chemical Corp., Foote Mineral Co. and Lithium Corp. of America. The Institute has been formed to meet the growing necessity for a central organization staffed to direct research on problems of an industry-wide nature. It will also act as an agency for the correlation and dissemination of technical information on lithium. The Institute's offices will be in Princeton, N. J.

**Expands Activities**—Arthur D. Little, Inc., has expanded its activities into the high-temperature field and is completing a solar furnace for such research. The staff has been engaged in extreme low-temperature research and the production of equipment for work within 8° of the lowest temperature possible; now they will also be working with temperatures up to 3500° F.

**Big Boy**—A vacuum furnace of new design, the largest in capacity of its type ever built, has gone into service at Mallory-Sharon Titanium Corp., where it will serve a dual purpose of quality improvement and heat treatment of titanium sheets.

**Stress Panel Fastener**—An advanced "foolproof" stress panel fastener, said to fasten and unfasten an airplane's access doors faster and easier than any other device of its kind, has been announced by Pastushin Industries, Inc. It was developed to meet increasing requirements for an easily operable mechanism to safely carry critical stress panel loads.

**Welding Graphite**—Welding of graphite has been accomplished for the first time, according to a report by National Carbon Co., which states that the key to melting together of graphite was the discovery that, when heated to high temperature, high pressure can prevent vaporization. The technique has already led to the production of new forms of graphite more crystally perfect.

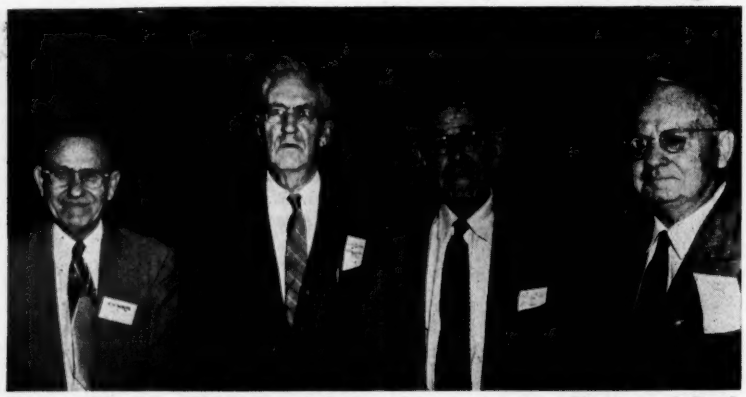
## *Atlanta Chairman Receives Gavel*

*Philip J. Duffy (Right) Accepts Gavel as New Chairman of Atlanta Chapter From A. Richard Boyd, Outgoing Chairman. (Photograph from J. Johnson)*

## *Rhode Island Holds Annual Clambake*

*Shown at the Rhode Island Chapter's Annual Clambake, Seated at the Head Table, Are, From Left: Sidney Siegel, Chairman; John Nelson, Past-Chairman; Nathan Acker, Entertainment Chairman; and Louis Lepore, Clambake Chairman. (Reported by Marshall C. Battey for the Rhode Island Chapter)*

## *Charter Members at Rockford Meeting*



*Charter Members Who Attended the 35th Anniversary Meeting of Rockford Chapter Were, From Left: Cletus V. White; George C. Nash (Standing in for W. K. Young, Recently Deceased); L. Rossier; and J. B. Fredericks*

## Surveys History of Work In Plastic Deformation

Speaker: P. F. Chenea

*Purdue University*

**Purdue Chapter** members heard a talk on "Plastic Deformation" by P. F. Chenea, associate dean of engineering, Purdue University.

The field was pictured as being composed of two approaches, physical and mathematical, upon which the design engineer must rely for help in solving his problems. Under the "physical" heading were grouped the physicist, physical metallurgist, physical chemist, materials engineer and rheologist. The physicist's areas of past activity include the macroscopic study of crystal symmentry; lattice theories and models of crystalline solids which have found success in predicting structure-insensitive properties; and quantum mechanics as a means of analyzing interatomic and interionic force fields. Present efforts are concerned with the concept of the neary perfect rather than perfect crystal. Such imperfections arise from local peaks of energy concentration, vacant lattice sites, impurity atoms and dislocations. The surface properties of crystals are also now of great interest. The contributions of the physical chemist, a relative neophyte in the field, are the semi-empirical reaction-rate theories of thermally-activated processes. In the "never-never" land between the microscopic and macroscopic picture, the physical metallurgist attempts to correlate chemical composition and heat treatment with observed properties. Perhaps most closely allied with the design engineer is the materials engineer who compiles extensive test data while the obscure rheologist interests himself in the straining of all materials crystalline and noncrystalline.

Opposing the physical is the mathematical group which includes the fields of pure and applied mathematics and applied mechanics. Here the concept of the "ideal plastic" is useful in calculating stresses in structural and machinery elements. Statistical analyses are often used to interpret nonhomogeneous models.

The sophisticated approach of the mathematician creates a quagmire of symbols and figures through which members in the engineering sciences are reluctant to wade and the mathematician seems to view the study of opposing theories with equal disdain. There is consequently little cross-fertilization between the two dissenting groups. Such top-priority design problems as the ICBM and super-sonic flight, with their heavy financial backing and spirit of cooperation between mathematician and engineer, may some day contribute significantly to a clear concept of plastic deformation.—**Reported by W. H. Faulkner for Purdue.**

## Presents Analysis of Service Failures at Philadelphia Meeting

Speaker: S. W. Poole
*Republic Steel Corp.*

The **Philadelphia Chapter's** past chairmen were honored at a meeting at which Sidney W. Poole, supervisor, Titanium Research Laboratory, Republic Steel Corp., spoke on "Analysis of Service Failures".

Mr. Poole discussed the fact that most metal failures in service are not due to metallurgical defects. The failed part has a clean bill of health, and no metallurgical condition, as such, is apparent as a cause for premature failure. The more subtle effects of such factors as stress and its distribution during service and residual or locked-in stresses not properly relieved are more often the cause of failure.

Interesting slides of photographs and photomicrographs were shown to illustrate case histories of service failure as they were presented. One of the main causes for service failure is too small a fillet at a change of section, or no fillet at all. These sharp corners set up stress concentrations which usually lead to failures.

In many cases it was found that an alloy steel was used, but that it had been put into service in the annealed, rather than a quenched and tempered condition. A coarse, lammellar, pearlitic structure was found in shafts where high rates of loading were required.

Other causes of failure noted were the effect of service atmospheres where the metal becomes contaminated by pickup from the surrounding atmosphere, as, for example, plain carbon steel in a reactor vessel, exposed to hydrogen and ammonia at elevated temperatures. Poor machining practice, incipient grinding cracks and the effects of overheating and burning were also illustrated with relation to service failures.

The most reliable methods used to reveal defects before a part is put into service include such procedures as magnetic particle analysis, ultrasonic inspection and careful visual inspection.

The speaker pointed out that service failures may be minimized by good design, proper heat treatment, careful machining and grinding, and, in some cases, surface cold rolling to induce compressive stresses in critically stressed areas.—**Reported by Harold Foy for Philadelphia Chapter.**



## *Summarizes Uses of Stainless Steels*

*George E. Rowan, Development Engineer, Atlas Steels Ltd., Gave a Talk on the "Use of Stainless Steels in the Metal Industry" at a Meeting of the Western Ontario Chapter. Shown are, from left: Forbes McLauchlin, Atlas sales representative; T. Carson, technical chairman; Mr. Rowan; and Bert Blair, chairman of the chapter. (Reported by W. F. Clinton)*

## *Milwaukee Honors 25-Year Members*

*The Milwaukee Chapter Honored Its Silver Jubilarians at a Meeting During Which National President Donald S. Clark, California Institute of Technology, Presented a Talk on the "Dynamic Properties of Metals". Dr. Clark is shown, front, center, with twenty-five year members of the chapter*

## *Past Presidents Meet in New York*

*Past Chairmen Who Attended a Meeting of the New York Chapter Included, Front, From Left: Doug Boyd, Jos. T. Ryerson; J. J. Preisler, Sperry Gyroscope; W. C. Mearns, International Nickel; J. W. Sands, International Nickel; R. W. Moore, Socony Vacuum Oil Co. Second row are: J. S. Vanick, International Nickel Co.; T. D. Parker, Climax Molybdenum Co.; and Sam Tour, Sam Tour & Co. Present also but not in the photograph were George Stradar, Fairchild Camera & Instrument Co.; Walt Stadtler, International Business Machines; and John Nielsen, New York University*

## *Briefs New Haven on Fuel Elements*

*Paul Lowenstein (Right), Group Leader of the Fabrication Department, Nuclear Metals, Inc., Spoke on "Metallic Fuel Elements, Metallurgy and Fabrication" at a Meeting in New Haven. He is shown with Albert I. Blank, Chase Brass & Copper Co., the technical chairman of the meeting*

**OBITUARIES**

KARL DAYTON WILLIAMS, a long-time member of the Washington Chapter, died in September. "K.D." joined the Bureau of Steam Engineering, Navy Department, as an assistant inspector in 1910 after serving five years in the forging department at Midvale Steel Co. In 1917 he became the first civilian metallurgical engineer of the Bureau of Steam Engineering and civilian head of the Specification and Inspection Division. Reorganization placed him as head of metallurgy of the Bureau of Ships, in which capacity he served for many years.

K.D. effectively advanced the use of alloy steel in naval propulsion machinery, for which he earned A. S. M.'s Distinguished Service Award, and he was granted the Government's Distinguished Civilian Service Award in 1945.

During World War II he was a member of and advisor to the National Emergency Steel Specification Technical Committee of the War Production Board. He served as vice-chairman of the Interdepartmental Screw Thread Committee and was effective in bringing about International Unification of screw threads. He was also civilian head of the Standards Branch and gained the high respect of the various technical societies and, with it, their cooperation. He was awarded a commendation by the American Standards Association.

Mr. Williams retired in 1949 after 39 years of service with the Navy Department.

♦ ♦ ♦

EDGAR DIXON, 62, vice-president and chief metallurgist of the Ladish Drop Forge Co., died early in November after an illness of four weeks.

Mr. Dixon was with Ladish for almost 29 years. He was born in Chicago and earned his degree at the University of Illinois. He was a member of the Milwaukee Chapter.

♦ ♦ ♦

JAMES KNIVETON, vice-president, engineering, Selas Corp. of America, died early in November after a short illness.

Associated with Selas since 1935, when he joined the company as an engineer, Mr. Kniveton was responsible for many heat processing developments in the metal, ceramic, glass and other industries, and a number of patents have been issued in his name.

## Is There a Precedence?

A letter recently received from one of our chapter officers sets forth an interesting occurrence and asks a few questions:

"Unless we have another Stassen-Nixon situation, in all likelihood I will be elected president of the Worcester (Mass.) Engineering Society next year. I am now serving as first vice-president. The W.E.S. is the mother of 10 affiliates, including the Worcester Chapter A.S.M.

"I was A.S.M. chapter chairman in 1952-53. My brother, Prof. Carl G. Johnson, Worcester Tech, was chapter chairman in 1929-30 and was also a president of the Worcester Engineering Society.

"Here is what I would like to know. Have there been any other cases in which two brothers were A.S.M. chairmen?

"Also, perhaps you can help me in this respect too. Do you know, or could you find out if there is a record of two brothers having served as presidents of a city engineering society, like the Worcester Engineering Society?

"Maybe we have a first here in Worcester, in which two brothers were chairmen of the A.S.M. chapter and then moved on to be presidents of the mother engineering society.

"Anything you could do to help me in this respect would be greatly appreciated."

Signed/Wendell J. Johnson
Worcester, Mass

## Argonne Announces Science Appointments

Argonne National Laboratory invites applications from faculty members and graduate students who are United States citizens for temporary research and development appointments in chemical, electrical and mechanical engineering, metallurgy, metallurgical engineering, ceramics, nuclear engineering and physics. Appointments are available to academic personnel who wish to use the Laboratory's unique research and development facilities. Argonne is operated by the University of Chicago under a contract with the United States Atomic Energy Commission.

Faculty appointees will spend full time in research or development and will be paid commensurate with their academic salary. Appointments will be made for a period of approximately one year, at the end of which the individual will return to his sponsoring institution, or for summer employment.

Graduate student appointments will be made to students who have completed all course work, passed all qualifying examinations and wish to do research work for advanced degrees from their universities, for a period of approximately one year. Such applicants will be considered upon the recommendation of their department head.

Further information and application blanks may be obtained from: Professional Personnel Office, Argonne National Laboratory, P. O. Box 299, Lemont, Ill.

Applications for summer employment should be received not later than Jan. 15, 1957.

# IN RETROSPECT

Production and heat treatment of large forgings for high-pressure steam installations began to interest A.S.M. members some 30 years ago when ADOLPH SCHAEFER, assistant engineer of tests for the Midvale Co., presented a paper on the subject in the June 1925 issue of *Transactions*. Mr. SCHAEFER, immediate past president A.S.M. and director of research for Midvale-Heppenstall Co., has since become one of the country's foremost authorities on this subject (see "Current Studies of Large Forgings", *Metal Progress*, April 1956).

♦ ♦ ♦

An editorial in a 1925 issue of *Iron Age*, reproduced in the A.S.S.T. *Transactions*, speculates on the reason for the falling off of metallurgical literature produced by other technical societies as contrasted with the remarkable growth of the American Society for Steel Treating. The editorial attributes this to the existence and development of a vital idea.

♦ ♦ ♦

To quote from the *Iron Age* in 1925: "Fifteen years ago a metallurgical microscope was almost a museum curiosity. The change in a few short years was strikingly shown at Schenectady last month. R. B. MCCOLL, manager of the American Locomotive Works, speaking at the Steel Treaters meeting there said that 45,000 lb. of heat treated steel now goes into every locomotive. At his elbow sat WILLIAM S. BIDLE, president of the society, a young man at that, who started life selling forged wrought iron locomotive frames!"

♦ ♦ ♦

Special credit for the sectional meeting at Schenectady is given to B. H. MAGILL, chairman of the Schenectady Chapter, and JAMES TAYLOR, secretary (now deceased), as well as GERALD R. BROPHY (now manager, New England Technical Section, International Nickel Co., and a past chairman of the Hartford Chapter) for their untiring efforts in carrying out arrangements for this meeting.

♦ ♦ ♦

Some of the speakers at the Schenectady meeting were W. E. RUDER, metallurgist of the Research Laboratory of General Electric Co. (retired), B. F. SHEPHERD, metallurgist of Ingersoll Rand Co., Phillipsburg, N. J. (a past A.S.M. national president), WILLIS R. WHITNEY, director of the research laboratory of General Electric Co. (now retired and an A.S.M. honorary member), Colonel T. C. DICKSON and F. C. LANGENBERG of Watertown Arsenal (both deceased), A. H. D'ARCAMBAL, metallurgist, Pratt & Whitney Co. (recently retired president of Niles-Bement-Pond Co. and a past national president of A.S.M.), and C. L. IPSEN of the industrial heating department, General Electric Co. (now Heating Equipment Association).

# *Talks on Cold Extrusion in Pittsburgh*


*John E. King, Heintz Manufacturing Co., Spoke on "How Cold Extrusion of Steel Is Shaping Up" at a Meeting of Pittsburgh Chapter. Shown at speaker's table are, from left: C. W. Garrett, Jones & Laughlin Steel Corp.; Mr. King; D. T. Rogers, Chairman; and L. C. Hill, Vice-Chairman*

Speaker: John E. King
*Heintz Mfg. Co.*

John E. King, Heintz Manufacturing Co., addressed a recent meeting of the **Pittsburgh Chapter** on the subject "Cold Extrusion of Steel Is Shaping Up".

The cold extrusion of steel was originated in Germany in the early 1930's as a consequence of economic and raw material limitations on the metals industry. Shortly after World War II the process was introduced in this country. Mr King discussed the development of cold extrusion since that time and presented numerous examples of current applications of the process.

Two basic extrusion operations, forward and backward extrusion, are the essential operations employed in this practice. To work steel cold through operations of this nature requires the use of a lubricant system which will withstand pressures of several hundred thousand pounds per square inch. For this purpose a special lubricant has been developed. It is a type of phosphate coating and soap lubricant which solved the problem of preventing metal contact between tools and the workpiece under even greater loads than normally used today.

The major advantage of cold extrusion is the appreciable cost savings which are brought about by several features of the process. A relatively high degree of surface finish and closer tolerances than can be attained by other forming techniques result in fewer machining and finishing operations. This means additional material savings and reductions in labor costs. Furthermore, the cold working of low carbon steels developes material properties which makes it possible, in some instances, to replace higher alloy steels with cold extruded parts, thus eliminating the final heat treatment.

Mr. King described the fabrication by cold extrusion of a number of different parts now in production. The manufacture of rocket heads and artillery shells has yielded up to 40% material savings over conventional fabricating methods. Similar savings are evident in commercial applications, especially in the automotive field where the use of cold extrusion of steel is expanding rapidly.

A color movie showing the cold extrusion of rocket heads was also shown.—**Reported by R. A. Wolfe for Pittsburgh.**

## Presents Discussion on Cutting Oils in Manitoba

Speaker: Ronald Holmes
*Imperial Oil Ltd.*

Ronald Holmes, industrial sales representative, Imperial Oil Ltd., presented a talk entitled "Cutting Oils as Applied to Machining Operations" at a meeting of the **Manitoba Chapter.**

Mr. Holmes outlined the various aspects of cutting oils and described the processes of metal cutting, chip formation, types of chip produced, built-up edges and other factors affecting the lubrication of the tool in the cutting zone.

Machinability of metals, with special reference to AISI standards, was then discussed. Properties and functions of cutting oils were described in detail, including the method of manufacture and the factors which influence the manufacturing process.

A summary covering the application of the various types of cutting oils and the advantages which can be realized by the proper selection and correct method of handling and application, concluded the talk.—**Reported by J. E. Graver for Manitoba.**

## Points Out Causes of Failures in Metals at Jacksonville Meeting

Speaker: Gerald R. VanDuzee

*Sikorsky Aircraft Division*

Gerald R. VanDuzee, senior process metallurgist, Sikorsky Aircraft Division, presented a talk on "Metal Failures" at a meeting of the **Jacksonville Chapter.**

Mr. VanDuzee opened with a brief discussion of the relationship between hardness, tensile strength and endurance limit and pointed out the detrimental effect of notches upon endurance limit. The behavior of defects as notches with the resultant lower endurance limit was pointed out.

Mr. VanDuzee then spoke of the value and limitations of the various methods used to detect defects. Some of the troublesome defects mentioned were forging and casting defects, grinding cracks and grinding burn, inclusions, hydrogen embrittlement, retained austenite and the use of incorrect heat treating temperatures. Slides were used to show various defects and the failures resulting from the presence of such defects in finished parts. Failures which resulted from poor shop practice such as deburring and from poor design were also shown.

A movie "Helicopters in Korea" was shown, and the meeting closed

*Gerald VanDuzee*

with a tour of the giant overhaul facilities at the Overhaul and Repair Department of the Naval Air Station where the meeting was held.—**Reported by H. J. Huester for the Jacksonville Chapter.**

## Clark Guest at Ontario

Speaker: D. S. Clark

*President A.S.M.*

At its Past Chairman's Night meeting, **Ontario Chapter** members were privileged to hear a most interesting and informative address by Donald S. Clark, president A.S.M.

His subject "What Do Dynamic Laboratory Tests Tell Us?" gave a better perspective of the relationship between laboratory research and service in the field.

He indicated that much remains to be done in metal research and, although the best test is still under operational conditions, laboratory research provides data which assist the designer in meeting service requirements. He stressed the importance of having a thorough knowledge of material properties when studying the stress system. During his discussion of the effects of impact, he placed considerable emphasis on the relationship between plastic strain and critical velocity in compression and impact testing. Dr. Clark's talk presented the members with very useful facts and figures with which to assess the valuable contribution made by laboratory test to metal service in the field.—**Reported by E. R. Snell for Ontario.**



## Substitute Stainless Steels Described at Meeting in Wilmington

Speaker: A. J. Lena

*Allegheny-Ludlum Steel Corp.*

A. J. Lena, associate director of research, Allegheny - Ludlum Steel Corp., spoke on the "Chromium-manganese Stainless Steels" at a meeting held by the **Wilmington Chapter.**

Dr. Lena reviewed the history of the stainless steel industry, pointing out that the consumption of stainless steel has doubled each decade since commercial introduction about 1920. With present estimates indicating a continuation of this growth in demand, the shortage of nickel appears to be the major obstacle confronting the stainless steel industry.

With this background, Dr. Lena reviewed the properties of high-nickel stainless steels and the research efforts expended to duplicate these properties in stainless steels containing no nickel or nickel in greatly reduced amounts. Hence, the development of AISI types 201 and 202 which can be considered replacements for types 301 and 302. Dr. Lena was careful to point out that these new alloys should not be considered inferior substitutes since their properties, such as formability, weldability, strength and corrosion resistance are as good as these same properties in materials they replace.

Stainless steels for use in highly corrosive media present some additional problems but the development of types 204 and 204L promises to provide useful replacements for 304 and 304L. One interesting aspect of these new materials is their relative greater resistance to sensitization. This is demonstrated by tests which showed that more than 0.06% carbon was required to sensitize a chrome CRMnNi steel whereas less than 00.03% carbon is required in 18-8 types.

Some of these steels may be used in many applications where the 18-8 types are now employed.—**Reported by N. E. Whitcomb for Wilmington.**

## Reports in Pennsylvania On Metals and Atomic Power

Speaker: E. C. Miller

*Oak Ridge National Laboratory*

At a meeting of the **Northwestern Pennsylvania Chapter,** approximately 70 members and guests heard Edward C. Miller, Oak Ridge National Laboratory, speak on the subject "Metals and Atomic Power".

After a brief summary of background information concerning the splitting of the atom, Mr. Miller discussed the several elements which can lead to a fissionable material and illustrated how fission is accomplished in these elements.

Mr. Miller also talked about several materials which can be used for moderators and reflectors and gave reasons why some materials are better than others for these applications.

The speaker then described the materials which are used for fuel and coolants in the several reactors which are presently in operation in this country. He discussed the structural materials being used to fabricate the atomic reactor being built at Oak Ridge National Laboratory and the specialized welding techniques which had to be developed to complete this fabrication.—**Reported by W. W. Lynch, Jr., for Northwestern Pennsylvania.**

## Reclamation of Aircraft Discussed at Albuquerque

Speaker: J. J. Miller

*Sandia Corp.*

J. J. Miller of the Test Project Division, Sandia Corp., was the guest speaker at a meeting of the **Albuquerque Chapter.** His subject, "Metal Reclamation From War-Weary Aircraft", dealt with the salvaging of such World War II planes as the B-17's, B-24's, AT-6's and PBY's. The salvaging operations, performed by the Compressed Steel Co. of Denver, consisted of the breaking-up of the planes and melting them down for aluminum recovery. The non-aluminum metals were recovered as unmelted scrap.—**Reported by C. E. Arthur for Albuquerque.**

# A.S.M. Review of Current Metal Literature

***An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad Received During the Past Month***

*Prepared by the Technical Information Division of Battelle Memorial Institute, Columbus, Ohio*

## A
## General Metallurgical

**305-A. The British Iron and Steel Research Association.** *Metallurgia,* v. 54, no. 324, Oct. 1956, p. 166-172, 182.

Review of present studies on phases of iron and steelmaking. Problems for future research. (A9, ST)

**306-A. The Equipment of the British Non-Ferrous Metals Research Association.** E. C. Mantle. *Metallurgia,* v. 54, no. 324, Oct. 1956, p. 173-177, 182.

Facilities available to the Research Association. New uses have been found for old-established pieces of metallurgical apparatus. (A9, EG-a)

**307-A. The British Steel Castings Research Association.** A. H. Sully. *Metallurgia,* v. 54, no. 324, Oct. 1956, p. 178-182.

New research station, research in metallurgy, foundry practice and molding materials, steelmaking, plant engineering, industrial health. (A9, CI)

**308-A. Recycling Uranium Scrap.** Charles G. Manley. *Mines Magazine,* v. 46, Sept. 1956, p. 61 + 6 pages.

Opportunities in recovery of reactor fuel-fabrication scrap. (A8, U)

**309-A. A Preliminary Study of the Pyrophoric Properties of Zirconium Machinings and Standard Warning Labels for Zirconium.** W. W. Allison. *Westinghouse Electric Corporation, Atomic Power Division, U. S. Atomic Energy Commission WAPD-TM-14,* Sept. 1956, 13 p.

Study made to obtain immediate rules of thumb and indications of possible lines for fruitful research. (A7, G17, Zr)

**310-A. (Italian.) Constitution of Slags Coming From Lead Furnaces.** F. Massazza. *Metallurgia Italiana,* v. 48, no. 9, Sept. 1956, p. 406-408.

Determination of components required chemical, metallographic, petrographic and X-ray tests. Main components are minerals of the olivine and melilite groups, wurtzite, spinels, magnetite, wüstite and glass. (A8, B21, S11, Pb)

**311-A. (Russian.) Appraisal of Working Conditions in Various Types of Arc Welding.** E. I. Vorontsova and T. S. Karacharov. *Svarochnoe Proizvodstvo,* no. 9, Sept. 1956, p. 12-14.

A general review, from the standpoint of health protection, of working conditions in manual arc welding, automatic and semi-automatic welding under flux, and automatic carbon dioxide-shielded welding. Suggests some health protection measures with respect to the airing of working places. (A7, K1)

**312-A. A Dictionary of Metallurgy.** A. D. Merriman and J. S. Bowden. *Metal Treatment and Drop Forging,* v. 23, Oct. 1956, p. 405-412.

From "thermodynamic scale" to "Tophet". (To be continued.) (A10)

**313-A. Accident and Fire Prevention Information.** *U. S. Atomic Energy Commission,* TID 5365, Aug. 1956, 30 p.

Summaries of a number of accidents from zirconium metals, giving recommendations for future safe handling. (A7, Zr)

**314-A. Steel Production in Latin America.** Georg Bulle. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 293-303.

Comparison of possible steelmaking processes; layout of Latin American steelworks; production data; raw material requirements. (A4, A5, D general, ST)

**315-A. The Balance of Materials and the Economic Comparison of the Different Steelmaking Processes.** Ernst Krebs. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 303-315, 320-330.

Operational economies are compared, based on the material balance-sheet per ton of crude steel. (A4, D general, ST)

**316-A. Comparative Investment Costs for Different Steelmaking Processes.** Charles F. Ramseyer. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 316-327, 330-331.

Study of the relative capital investments required to make steel by different processes. Includes production costs and plant and equipment requirements. (A4, ST)

**317-A. Selection of Steelmaking Processes and of Locations for Integrated Iron and Steel Works.** Wm. A. Haven. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 347-358, 365-366.

Raw materials, markets, transportation, fuel and labor aspects. (A4, D general, ST)

*The coding symbols at the end of the abstracts refer to the ASM-SLA Metallurgical Literature Classification. For details write to the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.*

**318-A. (Polish.) Application of the Electrolysis of Zincates for Recovering Zinc From Zinciferous Wastes.** W. Rutkowski and B. Winsch. *Prace Instytutow Ministerstwa Hutnictwa,* 1956, no. 3, 1956, p. 163-166.

Zinc is recovered from the cinders of a dust trap on a copper shaft furnace with an efficacy of 93 to 94%. (A8, C23, Zn)

**319-A. (Russian.) Damascus Steel and Modern Iron-Carbon Alloys.** I. S. Gaev. *Metallovedenie i Obrabotka Metallov,* no. 9, Sept. 1956, p. 17-24.

Mechanical properties of Damascus steel, possibility of reproducing some of them in modern mass-produced iron-carbon alloys. (A2, ST)

**320-A. (Book.) Uranium and the Atomic Industry.** Oliver Townsend and James Greene, editors. 183 p. 1956. Atomic Industrial Forum, Inc., 3 East 54th St., New York 22, N. Y.

Production, American industry as related to international program, demands for energy, AEC program and policies, competitive sources, developments in Canada. (A general, U)

**321-A. (Book—German.) Ores and Metals. Statistics.** 156 p. 1956. *Minerais et Métaux,* 61 Avenue Hoche, Paris, 8 France.

World statistics for the years 1935 to 1938, and 1948 to 1955 concerning copper, lead, zinc, tin, antimony, cadmium, cobalt, nickel, aluminum, magnesium, mercury, silver and gold. (A4)

**322-A. (Book—Spanish, French, English, German and Italian.) Twenty-Eighth International Congress of the Chemical Industry.** v. I-II. 1479 p. 1955 p. Saez, Buen Suceso 14, Madrid, Spain.

A collection of information transacted at the Congress, and of lectures and articles on researches and studies performed in Spain and abroad in the fields of chemistry, nuclear chemistry, metallurgy, etc., and various industrial products. Pertinent papers abstracted separately. (A general)

## B
## Raw Materials and Ore Preparation

**255-B. Evolution of Iron Ore Beneficiation Processes.** Stephen E. Erickson. *Blast Furnace and Steel Plant,* v. 44, Oct. 1956, p. 1159-1167.

Graphic description of ore ship-

ments, prices, analyses. Changes in plant layout and processing procedures. (To be continued.) (B14, A4, Fe)

**256-B. Studies on the Beneficiation of Low Grade Beryl Ores by Flotation.** N. R. Srinivasan and H. S. Aswath. *Indian Institute of Science, Journal,* v. 38, sec. B, July 1956, p. 135-142.

Tests revealed no selective separation in the case of froth flotation of quartz; good separations were obtained in the case of beryl. (B14, Be)

**257-B. Modernization of Bunker Hill Presintering Practices.** Harold E. Lee and Donald Ingvoldstad. *Mining Engineering;* v. 8, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 205, Oct. 1956, p. 1001-1005.

New crushing, storage-proportioning-blending, bedding and pelletizing plants were designed and constructed for preparation of suitable presintering materials. (B14, B13, B16, Pb, Ag)

**258-B. Preconcentration of Primary Uranium Ores by Flotation.** Burt C. Mariacher. *Mining Engineering,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 205, Oct. 1956, p. 1006-1007.

Flotation process was developed that fulfilled the concentration objectives for low-grade ores. Pilot plant testing was used to verify results obtained from laboratory batch testing. (B14, U)

**259-B. Flotation of Secondary Uranium Minerals.** John N. Butler and Robert J. Morris. *Mining Engineering,* v. 8; *American Institute of Mining and Meallurgical Engineers, Transactions,* v. 205, Oct. 1956, p. 1008-1011.

Additions of certain base metal salts aided in recovery and materially increased the rate of flotation and selectivity of the collectors for the synthetic minerals. (B14, U)

**260-B. How Anaconda Recovers $U_3O_8$ From Sandstone Ore at Bluewater Mill.** George O. Argall, Jr., *Mining World,* v. 18, Oct. 1956, p. 46-51, 91.

Anaconda mill development and expansion, equipment design, neoprene lining, ore processing, metallurgical advances, mill processes and procedures. (B14, U)

**261-B. The Solvent-Solvent Extraction of Uranium From Sulfuric Acid Solutions With Oil Soluble Amines.** Al Preuss and Jean Saunders. *Rohm and Haas Company Research Laboratories (U. S. Atomic Energy Commission),* RMO-2533, Apr. 1955, 39 p.

Use of liquid amines in a kerosene diluent for extraction of uranium from sulfuric acid leach solutions is possible. The most promising amines were studied to determine optimum operating conditions. (B14, U)

**262-B.** (Spanish.) **Industrial Production of Uranium.** Jovino D. Pedregal. Paper from "XXVIII Congreso Internacional de Quimica Industrial". v. I. Saez, p. 489-492.

Several suggestions on the purity to be expected from metallic uranium, especially before metallurgical treatment. Spanish methods for purification of uranium compounds. (B14, U)

**263-B. Development of Ore Dressing Procedures for Canadian Ores.** L. E. Djingheuzian. *Canadian Mining Journal,* v. 77, Oct. 1956, p. 75-81.

Notes on dressing procedures for recovery of 12 different metals obtained in ores from several sources. (B13, B14)

**264-B. The Reproducibility of Test Results in an Experimental Sinter Box.** C. Lang and J. M. Ridgion. *Iron and Steel Institute, Journal,* v. 184, Oct. 1956, p. 172-177.

Better results were obtained with the segregated feed box and with the deeper beds. (B16, Fe)

**265-B. Selective Extraction of Mercury and Antimony From Cinnabar-Stibnite Ore.** E. G. Erspamer and R. R. Wells. *U. S. Bureau of Mines, Report of Investigations* 5243, Sept. 1956, 15 p.

Bulk flotation of sulphides, followed by furnacing of the concentrate with carefully regulated admission of air, yields over 95% of the mercury and permits possible recovery of antimony from the furnace calcine. Leaching of ores or concentrates with sodium sulphide solution is a potential means of obtaining separate mercury and antimony products. (B14, Hg, Sb)

**266-B. The Extraction of Uranium From a Saskatchewan Pegmatite Granite.** Brad Gunn, S. D. Cavers, and A. B. van Cleave. *Canadian Journal of Technology,* v. 34, Nov. 1956, p. 379-388.

Extensive leaching tests were carried out and possible methods of recovering the uranium from the pregnant leach solution studied. (B13, B14, U)

**267-B. Modernization of Bunker Hill Presintering Practices.** Harold E. Lee and Donald Ingvoldstad. *Journal of Metals,* v. 8, sec. 1; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1469-1473.

New plant of four distinct units: crushing plant; storage, proportioning and blending plant; bedding plant; and a pelletizing plant. (B13, B16)

## C
## Nonferrous Extraction and Refining

**283-C. Liquid-Liquid Extraction of Molten Uranium With Silver.** C. W. Watson and G. H. Beyer. *Ames Laboratory (U. S. Atomic Energy Commission),* ISC-696, Mar. 1956, 27 p.

Investigation to develop equipment and technology and some of the problems that might be expected in the processing of molten reactor fuels. (C general, U, Ag)

**284-C. Preparation of Zirconium From Zirconium Tetrafluoride.** C. J. Baroch and G. H. Beyer. *Ames Laboratory (U. S. Atomic Energy Commission),* ISC-720, May 1956, 18 p.

Experimental bomb reductions of this compound with magnesium. Results show that higher purity zirconium can be produced by this method. (C26, Zr)

**285-C. Ferrosilicon Manufacture at Marietta.** E. E. Thum. *Metal Progress,* v. 70, Oct. 1956, p. 65-72.

Cross-sectional drawing of submerged arc furnace and essential details of plant and operation for silicon metal and ferrosilicon. Production data. (C21, Si, Fe-n)

**286-C. Limitations to Processes Using a Metal as a Reducing Agent.** L. M. Pidgeon. *Metal Progress,* v. 70, Oct. 1956, p. 79-82.

Use of magnesium and calcium is limited by properties such as the free energy of formation of their slag reaction products, melting and boiling points, and tendency to alloy with the desired metal as it is produced. (C26, Mg, Ca)

**287-C.** (Russian.) **Electrochemical Separation of Binary Lead-Copper-Silver Alloys in a Melted Electrolyte.** A. A. Kolotii and In. K. Delimarskii. *Ukrainskii Khimicheskii Zhurnal,* v. 22, no. 4, 1956, p. 466-471.

Results of measurement of the equilibrium potentials of lead-silver and lead-copper in melted eutectic $PbCl_2$-KCl-NaCl. Measurement of anodic polarization. (C23, Pb, Ag, Cu)

**288-C. The Aluminium Smelter—Bell Bay, Tasmania.** *Light Metals,* v. 19, Oct. 1956, p. 317-319.

A tour of the first aluminum plant south of the equator, capable of producing 13,000 tons of aluminum per year. (C23, Al)

**289-C. Vacuum Metallurgy.** E. C. Roberts. *Trend in Engineering (University of Washington),* v. 8, Oct. 1956, p. 15-18.

Discusses thermal reduction, melting and casting, distillation and heat treatment. (C25, J2)

**290-C. Arc Melting Kroll Zirconium Sponge.** G. L. Miller. *Vacuum,* v. 4, Apr. 1954, p. 168-175.

Details an arc melting method developed for production of zirconium and zirconium alloy ingots. (C25, Zr)

**291-C.** (Czech.) **Making Ductile Zirconium by the van Arkel Method.** Frantisek Plzak. *Hutnické Listy,* v. 11, no. 9, Sept. 1956, p. 518-522.

Purest zirconium is made by the van Arkel method of thermal decomposition of zirconium iodide on a tungsten or zirconium filament heated to 1400° C. (C4, Zr)

**292-C.** (Czech.) **Production of Alpax (Silico-Aluminum) by Fractional Crystallization.** Albert Regner. *Hutnické Listy,* v. 11, no. 9, Sept. 1956, p. 514-518.

A process whereby the silicon is precipitated from a master mix in a stirred crucible and the pure eutectic remains behind. (C28, Al, Si)

**293-C.** (French.) **The Manufacture and Use of Ferro-Alloys.** H. Cartoux. *Chimie & Industrie,* v. 76, no. 3, Sept. 1956, p. 453-470.

Ferro-alloys are prepared in electric furnaces by reduction with carbon, or by aluminothermy or silicothermy for special alloys with low carbon content. (C21, Fe)

## D
## Ferrous Reduction and Refining

**366-D. Electronic Records Lead Way to Better Continuous Casting.** *Steel,* v. 139, Oct. 22, 1956, p. 86, 89.

Electronic instruments used to automatic production from molten metal to finished casting. (D9, S18)

**367-D.** (French.) **Tests at the Ougrée Low Shaft Blast Furnace.** F. Paschal. *Centre de Documentation Siderurgique, Circulaire d'Informations Techniques,* v. 13, no. 9, 1956, p. 1771-1775.

Study of the working conditions of an oval, low-shaft blast furnace with a double circular charging hole. Use of fuel in the form of carbonized anthracite briquettes. (D1)

**368-D.** (French.) **Study of the Zone of Turbulence in Front of the Tuyeres of the Ougrée Low Shaft Blast Furnace.** F. Paschal and R. Biver. *Centre de Documentation Siderurgique, Circulaire d'Informations Techniques,* v. 13, no. 9, 1956, p. 1777-1791.

Study of conditions in a low-shaft blast furnace in relation to blast turbulence, charge grain size and tuyere size varying from 50 to 80 mm. in diam. (D1)

**369-D. (French.) Comparison Between Basic Brick Roofs and Half-Siliceous Half-Basic Brick Roofs.** M. Mulsant. *Centre de Documentation Siderurgique, Circulaire d'Informations Techniques,* v. 13, no. 9, 1956, p. 1825-1829.

Economy and durability of brick, consumption, and furnace productivity with these two types of open-hearth roofs. (D2, B19)

**370-D. (French.) The Design of Ingot Molds. Square Ingot Molds for Electric Steel Plant and Flat Ingot Molds for Openhearth Plant.** J. Duflot. *Institut de Recherches de la Sidérurgie, Publications,* ser. B, no. 31, Sept. 1956, p. 569-603.

French procedures in the design of ingot molds compared with foreign practice. (D9, ST)

**371-D. (French.) Testing an Acid Poor Ore in Blast Furnace 7 at Neuves-Maisons. Comparison With Classic Process Used With Crushed Marion Ore.** M. Pasquet. *Institut de Recherches de la Sidérurgie, Publications,* ser. A, no. 140, Sept. 1956, 33 p.

Both ores were compared with respect to their iron and acid content, their reducibility and regularity, economic factors involved and the silica, sulphur manganese and phosphorus content of the cast iron obtained. (D1, CI)

**372-D. (German.) Smelting of Pure Iron by Carbon-Reduction Method and Impact Test Temperature Curves of This Iron.** Wilhelm Anton Fischer, Helmut Treppschuh and Karl Heinz Köthemann. *Archiv für das Eisenhüttenwesen,* v. 27, no. 9, Sept. 1956, p. 567-572.

Theoretical fundamentals of preparation of pure iron, reaction between smelting and ladle, work under high vacuum, new desulphurization process, determination of properties. (D general, Q6, Fe)

**373-D. (German.) Hot Cooling of Blast Furnace Tuyeres.** Karl Schilcher. *Stahl und Eisen,* v. 76, no. 19, Sept. 20, 1956, p. 1229-1231.

Basis for the experiments, technical details, temperature conditions encountered in a tuyere. (D1)

**374-D. Contribution to Arc Furnace Operations.** L. A. Wynd. *Iron and Steel Engineer,* v. 33, Oct. 1956, p. 135-142.

Among the improvements resulting in 70% production increases are top charging, optimum current control and increased secondary voltage. (D5, ST)

**375-D. Electric Open Hearth Combustion Controls at Algoma.** A. K. Bayles and D. M. Stanton. *Iron and Steel Engineer,* v. 33, Oct. 1956, p. 143-147.

Controls for furnace pressure, reversal, roof temperature, fuel-air, oil-steam and oil-gas ratios, B.t.u. input and flow of oil, steam, gas and combustion air. (D2)

**376-D. A New Approach in Electric Pig Iron Smelting.** F. C. Collin and O. A. Grytting. *Journal of Metals,* v. 8, sec. 1; Oct. 1956, p. 1464-1468.

Experimental technique, tests with only preheating, preheated and prereduced charge, scaling up, application of new practice. (D1, CI)

**377-D. Pig Iron Production in Blast Furnaces Using Charcoal.** Louis Ensch. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 154-158, 165-166.

Description of blast furnaces and comparison with electric furnaces. Forest resources, charcoal production, use of coke. (D1, CI)

**378-D. Progress in the Manufacture of Pig Iron and Ferro-Alloys With the Low-Shaft Electric Furnace.** Hermann Walde. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 167-172.

Characteristics and advantages of electric heating method, study of carbon-bearing materials, fuels, power and furnace construction and problems of ferro-alloy production. (D1, Fe)

**379-D. The Electric Reduction Furnace.** Alfonso Ballon. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 172-175.

Power consumption and economic considerations. (D1, D5)

**380-D. Operation of the Charcoal Blast Furnace at Corral Using Mixtures of Metallurgical Coke and Charcoal.** Danilo Vucetich. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 158-162, 166.

Outline of present and planned operating conditions. (D1, CI)

**381-D. Electric Smelting of Pig Iron.** M. O. Sem. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 175-178, 180-181.

Data on furnaces in various countries, reduction in power consumption, preheating and prereduction of the charge, the rotating hearth furnace. (D1, CI)

**382-D. The Krupp Renn Process.** Friedrich Johannsen. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 192-200, 203.

Process is carried out in a rotary kiln. Individual particles of sponge iron are welded together at temperatures from 1200 to 1300° C., whereby larger iron nodules free of slag, called "luppen" are formed. (D8, Fe)

**383-D. Production of Sponge Iron According to the Wiberg-Söderfors Method.** John Stalhed. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 204-209.

Reduction gas, consisting of carbon monoxide and hydrogen in ratio 2:1, is generated in an electrically heated carburetor, in which the gas fed back from the reduction furnace shaft is brought to react with the fuel. Various ores and reducing agents are discussed. (D8, Fe)

**384-D. The Basset Process for the Production of Pig Iron in Rotary Kilns.** Knud E. Jensen. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 210-216, 228.

Complete smelting process is carried out in rotary kiln. The kiln, raw materials, advantages and economics of the process are discussed. (D8, CI)

**385-D. The Rotary Kiln Processes for Sponge Iron, Developed at the Avesta Iron and Steel Works and the Domnarfvet Iron and Steel Works, Sweden.** Bo Kalling. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 216-219, 229.

Furnace construction and production procedures. (D8, Fe)

**386-D. Production of Sponge Iron in a Rotary Kiln at Temperatures Below the Fusion Point of the Material.** Russell C. Duehl. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 220-228, 229-230.

Process and equipment, review of results, operating data, suitable raw materials, costs. (D8, Fe)

**387-D. The Acid Bessemer Process.** W. O. Philbrook. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 231-242, 265-266.

Applications, specifications and limitations of bessemer steel, raw materials used in its manufacture, and technology and economics of the process, with reference to current practice in the U. S. (D3, ST)

**388-D. Basic Open-Hearth Steelmaking Practice in the United States of America.** William C. Buell, Jr. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 242-250.

Charge materials, processing in openhearth furnace, chemistry of process and its product, composition of resulting steel, ingot capacity of the Americas. (D2, ST)

**389-D. Economics of the Modern Acid Open-Hearth Practice.** G. R. Fitterer. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 251-258.

Recent technological advances have increased method's advantages, among which are reduced costs, little or no ore addition and greater production rate. (D2, A4, ST)

**390-D. Manufacture of Thomas (Basic Converter) Steel at Paz de Rio, Colombia.** Edouard Decherf. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II, United Nations, p. 259-265.

Presents the main departures from current European Thomas steelmaking practice imposed by local conditions, such as: quality of raw materials, altitude above sea level, size of plant and production program of the rolling mills. (D3, ST)

**391-D. Perrin Process for Converter Steelmaking.** Marc Allard. Paper from "Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 277-282.

Precautions concerning blowing in basic converter process. Rapid refining method. (D3, ST)

**392-D. Thomas Steel With Low Nitrogen and Phosphorus Contents.** P. Coheur. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 282-289, 291-292.

Indicates that blowing with oxygen-enriched air or with a mixture of oxygen and steam permits production of Thomas steels with exceptionally low nitrogen and phosphorus content. Ductility is excellent and converter capacity is increased. (D3, ST)

**393-D. Desulfurization of Pig Iron With Pulverized Lime in Rotary Kilns.** Bo Kalling. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 333-337.

Process differs from previous methods in that the pulverized burnt lime does not melt but remains solid during the whole treatment. Rapid and effective desulphurization can be obtained with a low consumption of lime. (D8, CI)

**394-D. The Acid Bessemer Process at Huachipate, Chile.** Héctor Canguilhem. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 360-363, 367.

Raw materials and specifications, refractory and blowing practices, tapping and late additions, teeming, production tonnages and yields. (D3, ST)

**395-D. Continuous Casting of Steel by the Rossi-Junghans Process.** T. Y. Wilson. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 368-373.

Equipment and operating procedures. (D9, CI)

**396-D.** (Czech.) **The Production of Transformer Steel by a Combined Method in Openhearth and Electric-Arc Furnaces.** Karel Hybek and Frantisek Poboril. *Hutnické Listy,* v. 11, no. 9, Sept. 1956, p. 529-532.

Data concerning the influence of different elements on electromagnetic properties of transformer sheets. (D7, P16, AY)

**397-D.** (Czech.) **Determination of Iron Ore Reducibility.** Frantisek Wald. *Hutnické Listy,* v. 11, no. 9, Sept. 1956, p. 532-536.

Importance of knowing the reducibility of an ore. Work done is on the basis of Kräber-Luyken's method. (D general, Fe)

**398-D.** (French.) **Improving the Productivity of a Steel Plant Using the Thomas Process, With Wide Bottom Converters.** L. Septier, J. de Hedouville, P. Leroy and L. de Saint-Martin. *Institut de Recherches de la Sidérurgie, Publications,* ser. A, no. 147, Sept. 1956, p. 1-30. (Reprinted from *Circulaire d'Informations Techniques* du Centre de Documentation Sidérurique, no. 7, July 1956.)

Three types of converters compared. A 30% increase in productivity was obtained by using a large bottom converter with more tuyeres. (D3, ST)

**399-D.** (French.) **New Converter Designs.** P. Leroy. *Institut de Recherches de la Siderurgie, Publications,* ser. A, no. 146, Sept. 1956, p. 1405-1413. (Reprinted from *Circulaire d'Informations Techniques* du Centre de Documentation Siderurgique, no. 6, July 1956, p. 1405-1413.)

Essential geometrical features of steel works converters: inside lining profile, apron profile, bottom diameters, characteristics of gooseneck, windbox and tuyeres. (D3, ST)

**400-D.** (French.) **Basic Steel Obtained by Blowing With Oxygen-Carbonic Acid Mixture (Elaboration, Laboratory Tests, Industrial Results).** P. Boutonnet, A. Richard, P. Mathieu and R. Maret. *Revue de Métallurgie,* v. 53, no. 9, Sept. 1956, p. 665-681.

Results with some 50 castings indicate that this steel may be advantageously compared with openhearth steel. (D3, ST)

**401-D.** (Polish.) **New Results of Investigations of the Process of Ferrous Oxide Reduction by Carbon.** M. S. Kurczatow. *Prace Instytutow Ministerstwa Hutnictwa,* v. 4, no. 8, 1956, p. 169-184.

Studies indicate that reduction by carbon may proceed according to two types of reactions—primary dissociation of oxides under the effect of activated adsorption, or catalytic adsorption reduction of oxides by carbon monoxide which takes place in consequence of chemical adsorption. (D general, Fe, CI)

**402-D.** (Polish.) **Melting Steel and Alloys in Vacuum.** H. Zakowa. *Prace Instytutow Ministerstwa Hutnictwa,* v. 4, no. 8, 1956, p. 207-214.

Physico-chemical processes which take place during the melting of steel in vacuum, and also during its deoxidation. (D8, ST)

**403-D.** (Polish.) **The Heating Cycle in Openhearth Furnaces,** Antoni Kolano. *Wiadomosci Hutnicze,* v. 12, no. 9, Sept. 1956, p. 267-271.

Problems of heating the openhearth, and more efficient utilization of fuel. Some of the errors to be avoided. (D2)

**404-D.** (Swedish.) **The Use of Oxygen in Steel Production.** Folke Johansson. *Jernkontorets Annaler,* v. 140, no. 9, 1956, p. 607-673.

A critical review of the present methods of using oxygen in steelmaking. The new oxygen steel process (the LD process), developed to full-scale production in Austria, also discussed. (D3, ST)

**405-D. Sulfur Equilibria Between Gases and Slags Containing FeO.** George R. St. Pierre and John Chipman. *Journal of Metals,* v. 8, sec. 1; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1474-1483.

Experimental program to determine equilibrium sulfur content in slags exposed to gases of known oxygen and sulphur pressures. (D2)

**406-D** (Russian.) **The Question of the Movement of Charge in the Blast Furnace.** V. K. Gruzinov. *Stal',* v. 16, no. 9, Sept. 1956, p. 771-773.

Materials descend in the blast furnace because of the coke burning in the tuyere zone, and because of fusion and partial gasification on the way. The braking effect of the bosh is found to be exaggerated. (D1, Fe)

**407-D** (Russian.) **Advantages of the Tilting Openhearth Furnace Over the Stationary Furnace.** K. G. Trubin, *Stal',* v. 16, no. 9, Sept. 1956, p. 780-782.

A review on the use of tilting furnaces in foreign countries, particularly in Britain and Germany. (D2, Fe)

**408-D.** (Russian.) **The "Dead" and "Wild" Phases of an Electric-Arc Furnace.** V. F. Ivan'ko. *Stal',* v. 16, no. 9, Sept. 1956, p. 794-797.

Reducing voltage discrepancy between two of the electrodes of a three-phase electric-arc furnace to preserve the lining, accelerate melting, reduce power consumption, and avoid excessive carburization of the metal. (D5, ST)

**409-D.** (Spanish.) **A Contribution to the Study of Electrolytic Purification of Steels.** José Ibarz Aznarez and Sebastian Feliu Metas. *Revista de Ciencia Aplicada,* v. 10, no. 50, May-June 1956, p. 233-240.

Electrolytic purification of steel in a bath of sulphuric acid, methyl alcohol and ethyl alcohol. Conditions and interpretation of process. (D8, ST)

**410-D.** (Book.) **Oxygen in Iron and Steel Making.** J. A. Charles, W. J. B. Chater, and J. L. Harrison. 316 p. 1956. Interscience Publishers, Inc., 250 Fifth Ave., New York, N. Y. $6.50.

An exhaustive summary of literature through 1955. Deals with treatment of molten metal with oxygen, blast enrichment with oxygen in solid fuel combustion and flame enrichment. (D general, B22)

**411-D.** (Book.) **A Study of the Iron and Steel Industry in Latin America. v. I-II. Report on and Proceedings of the Meeting of the Expert Working Group Held at Bogota.** 123 and 449 p. 1954. United Nations, Department of Economic Affairs, New York, N. Y.

Economic status of the industry. Numerous papers dealing with new or experimental processes, both in relation to utilization of available coal reserves and to steelmaking itself. Selected papers individually abstracted. (D general, B general, A4)

## E Foundry

**559-E. Ladle Additions to Grey Cast Iron for High Duty Parts Without Disturbance of Normal Production.** C. R. van-der Ben. *Alloy Metals Review,* v. 8, Sept. 1956, p. 2-6.

Simple method of producing the higher grades of B.S.S. 1452 in a foundry not specially equipped for them. (E25, CI-n)

**560-E. Receivers, Tapping Systems and Slag Disposal.** *Foundry Trade Journal,* v. 101, Sept. 27, 1956, p. 349-355.

Five major tapping systems applied to the cupola; consideration of the continuous type. Slagging systems, refractories, advantages and disadvantages, metal composition. (To be continued.) (E10, E23)

**561-E. Receivers, Tapping Systems and Slag Disposal.** *Foundry Trade Journal,* v. 101, Oct. 4, 1956, p. 379-390.

Considers both fixed and portable, heated and nonheated receivers, with data on relative efficiencies and effect on metal composition and structure. Surveys fuels and fuel consumption, refractories control methods, slag containers, granulation systems. (E23)

**562-E. New Advances Swell Shell Molding Uses. I.** O. W. Winter. *Iron Age,* v. 178, Oct. 11, 1956, p. 108-110.

Metal sections 4 in. thick can be cast in ¼-in. shell molds; 100-lb. castings are now believed economically feasible. (E16, Cu)

**563-E. A New Composition for Fast Malleable.** A. L. Boegehold. *Metal Progress,* v. 70, Oct. 1956, p. 73-74.

A pinch of tellurium in high-silicon malleable produces white iron even in large sections; 0.025% bismuth plus 0.003% boron does the same thing and eliminates objectionable "foundrymen's halitosis". (E25, B22, CI)

**564-E. Expendable Molds for Titanium Castings.** A. L. Feild, Jr., *Metal Progress,* v. 70, Oct. 1956, p. 92-96.

Titanium castings can be produced free of internal porosity and with negligible surface contamination in molds made from a new graphite-base mixture. (E18, Ti)

**565-E. Casting Design.** Bernhard Rogge. *Product Engineering,* v. 27, Oct. 1956, p. 190-193.

Basic design considerations and recommended drafting practices. (E general)

**566-E. New Process for Making Nodular Iron.** *Steel,* v. 139, Oct. 22, 1956, p. 83-84.

Adding sodium and magnesium chlorides to molten iron with calcium silicides as a reducing agent is used to produce an easily machinable and ductile iron without annealing. (E25, CI)

**567-E.** (Hungarian.) **Desulphurizing Experiments With Different Basic**

**Cupola Linings.** Ferenc Varga. *Öntöde,* v. 7, no. 9, Sept. 1956, p. 201-209.

A study of the chemistry involved. (E10)

**568-E.** (Spanish.) **The Use of Sodium Carbonate in Metallurgy.** Juan Grau. Paper from "XXVIII Congreso Internacional de Quimica Industrial". v. I. Saez, p. 541-553.

Theory of the desulphurization of cast iron, its industrial technique, modern application. (E10, CI)

**569-E. Steel Castings Manufacture. Control Factors.** E. Longden. *Iron & Steel,* v. 29, Oct. 1956, p. 457-462.

Allowances for contraction, machining and manufacturing errors. Process and methods control cards. (E general, CI)

**570-E. Thin Permanent-Mould Castings. Design and Production Problems.** A. M. Petrichenko. *Iron & Steel,* v. 29, Oct. 1956, p. 473-477. (From *Liteinoe Proizvodstvo,* 1955, no. 7, p. 4-8.)

Design of castings, molds and casting systems. Prevention of chilling. Increasing strength of molds. (E12)

**571-E. Foundry Mould Surfaces.** H. M. Walter. *Iron & Steel,* v. 29, Oct. 1956, p. 485-486.

Test for the depth of skin dryness based on electrical conductivity of sand. (E19)

**572-E. High Temperature Sand Tests.** Harry W. Dietert, Victor M. Rowell and Alex L. Graham. *Modern Castings,* v. 30, Nov. 195, p. 50-51.

Mold surface failure, test equipment, scabs, rat-tails, buckles, veining, cuts and washes. (E18)

**573-E. Design Tips for Shell Pattern Equipment.** H. Weaver. *Modern Castings,* v. 30, Nov. 1956, p. 48-49.

Pattern materials, pattern plates, design of stripping pins and core boxes. (E17, E16)

**574-E. Precision Castings in a Bigger Way.** Adam Dunlop. *Modern Castings,* v. 30, Nov. 1956, p. 50-51.

Principles and molding methods involved in process producing quality steel castings weighing up to 700 lb. with no apparent limit on size. (E15, CI)

**575-E. Fast Aluminum Melting.** F. L. Turk. *Modern Metals,* v. 12, Oct. 1956, p. 54.

New dry hearth furnace speeds production, improves working conditions, and cuts cost of aluminum castings. (E10, Al)

**576-E.** (Czech.) **Production of Welding Rods by Means of Casting.** Zdenék Lehky, Zdenék Eminger and Karel Löbl. *Slevarenstvi,* v. 4, no. 9, Sept. 1956, p. 257-263.

Casting process for welding rods of cobalt-chromium-tungsten alloy and other combinations. (E11, T5, Co, Cr, W)

**577-E.** (Czech.) **Gases in Aluminum and Its Alloys.** *Slevarenstvi,* v. 4, no. 9, Sept. 1956, p. 268-272.

Current technological control methods for the gasification of aluminum alloys; degasification methods. (E25, Al)

**578-E.** (Dutch.) **Behavior of Damp Molding Sand Subjected to Sudden Heating and the Formation of Scab.** H. G. Levelink. *Metalen,* v. 11, no. 18, Sept. 1956, p. 402-408.

A surface layer of sand was subjected to rapid heating at 1300° C. Reactions caused by expansion capacity, adhesivity and type of components were observed. Principle applied to casting forms. (E18)

**579-E.** (German.) **Addition of Sawdust to Molding Sand.** Horst Eppstein. *Giesserei,* v. 43, no. 20, Sept. 27, 1956, p. 656-658.

Comparison of addition of coal dust, tar and sawdust to molding sand and the advantages of the latter. (E18)

**580-E.** (Polish.) **"Adequate" Coal Dust in Molding Sands.** Stefan Jarzebski. *Przeglad Odlewnictwa,* v. 6, no. 9, Sept. 1956, p. 286-292.

Behavior of the coal dust in sand explained; mold may be strengthened by this procedure. (E18, CI)

**581-E.** (Polish.) **Exothermic Mixtures for Risers.** Kazimierz Korecki and Tadeusz Welkens. *Przeglad Odlewnictwa,* v. 6, no. 9, Sept. 1956, p. 292-300.

Exothermic mixtures for nonferrous metals, nodular cast iron and cast steel are obtained by an alumino-thermic reaction. (E22, E25, CI, EG-a)

**582-E. Effect of Vibration on Aluminum Investment Castings.** D. W. Levinson, A. H. Murphy and W. Rostoker. *Light Metal Age,* v. 14, Oct. 1956, p. 26.

Preparation of molds. Compares castings vibrated before removal from casts and those not vibrated, the former being considered superior. (E15, Al)

**583-E. Pontiac Crankshafts Are Shell-Molded Castings.** R. C. Robinson. *Machinery,* v. 63, Nov. 1956, p. 154-161.

Operations of the highly mechanized foundry line are followed from molding the shell to final inspection of the crankshaft. (E16, CI)

**584-E.** (Italian.) **Automation in the Foundry. The Use of Thin Cases in Molding.** *Fonderia,* v. 5, no. 9, Sept. 1956, p. 459-462.

From preparation of sand to transportation of completed casts, through automation. Use of thin resin and sand molding cases. Advantages of the method. (A5, E general)

**585-E.** (Italian.) **Use of Carbon Dioxide in the Foundry.** *Fonderia,* v. 5, no. 9, Sept. 1956, p. 463-465.

Preparation of molding sands with a viscous and liquid alkaline binder, and further hardening of the cores and molds with carbon dioxide with no subsequent burning necessary. Advantages and limitations of the method. (E19)

# F

# Primary Mechanical Working

**233-F.** (German.) **Load Measurements on a Wide Strip Hot Rolling Mill.** Werner Lueg and Hans Günter Müller. *Stahl und Eisen,* v. 76, no. 19, Sept. 20, 1956, p. 1246-1248.

Devices for measurements of the rolling loads and torques required; practical results. (F23, ST)

**234-F. The Use of the Modern Assel Mill in Production of Seamless Tubing.** Charles E. Snee. *Iron and Steel Engineer,* v. 33, Oct. 1956, p. 124-134.

The elongator produces seamless tube with superior dimensional control in outside diameter to wall thickness ratios to a maximum of 12 to 1 at the elongator gorge. (F26, ST)

**235-F. Stepped Aluminum Extrusions, Present and Future.** C. J. Huffman. *Western Machinery and Steel World,* v. 47, Oct. 1956, p. 76-80.

Single, and perhaps multiple, stepped aluminum extrusions can simplify part design. Production procedures, mechanical properties and potential applications. (F24, Q general, Al)

**236-F. Automotive Zigzag Spring Wire.** Webster J. Van Horn. *Wire and Wire Products,* v. 31, Oct. 1956, p. 1184-1186; 1258-1259.

Current manufacturing practice and procedures for controlling quality. (F28, T7)

**237-F. Drawing Quality Aluminum Wire.** O. L. Burtenshaw and Richard E. Hutchinson. *Wire and Wire Products,* v. 31, Oct. 1956, p. 1197-1198, 1259-1262.

Basic principles of drawing, die design, suggestions from production experience. (F28, Al)

**238-F. Wire Flattening Theory. II.** R. D. Weber. *Wire Industry,* v. 23, Oct. 1956, p. 913-914.

Development of theory from collected data and calculations. (F28, ST)

**239-F. Notes on the Ugine-Séjournet Extrusion Process.** J. Séjournet. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 382-385, 391-392.

Types of presses, production operations and costs. (F24, ST)

**240-F.** (French.) **Study of Scales Formed on Ingots.** J. Moreau. *Revue de Métallurgie,* v. 53, no. 9, Sept. 1956, p. 703-714.

Scales on mild rimming steels before and after reheating in soaking pits studied by optical micrography, X-rays, and chemical analysis. (F21, M general, ST)

**241-F.** (German.) **Difficulties in Controlling Furnace Pressure.** Rudolf Jeschar. *Stahl und Eisen,* v. 20, no. 76, Oct. 4, 1956, p. 1284-1289.

Curve of furnace pressure, effect of leakage gap of throttle valve, infiltrated air, recuperator operation, occurrence of oscillation phenomena, remedial measures. (F21)

**242-F.** (Polish.) **Comparison of Roll Pressure Calculation Methods in Cold Rolling of Strip With Forward and Back Tension.** A. Galanty. *Prace Instytutow Ministerstwa Hutnictwa,* v. 4, no. 8, 1956, p. 215-229.

Optimal methods are established by calculations according to six different authors. (F23, Cn)

**243-F.** (Polish.) **Cold Rolling of Thin Steel Sheets.** Zygmunt Polek. *Wiadomosci Hutnicze,* v. 12, no. 9, Sept. 1956, p. 271-278.

General principles and practice. Description of process from preparation of the ingot to final treatment of the sheets. (F23, ST)

**244-F. "Stepped" Aluminum Extrusions.** C. J. Huffman. *Light Metal Age,* v. 14, Oct. 1956, p. 12-15.

Continuous extrusion of major and minor sections by interrupting process only long enough to change dies. Effects of abrupt change in flow pattern on mechanical properties. (F24, Q general, Al)

**245-F.** (Russian.) **Rolling of Railroad Rails.** B. V. Merekin. *Stal',* v. 16, no. 9, Sept. 1956, p. 803-805.

Prevention of rail deformation due to a torsional moment developing when the rail leaves the slanted roller groove. Suggests a shift of the center of gravity of the groove. (F23, ST)

**246-F.** (Russian.) **Continuous Rapid Heating of Tubing Before Reduction.** N. Iu. Taits, G. N. Kheifets and V. B. Tov. *Stal',* v. 16, no. 9, Sept. 1956, p. 826-830.

Advocates replacement of low-efficiency and unwieldy compartment kilns by continuous rapid-heating sectional furnaces. Advantages. (F21, ST)

## G
## Secondary Mechanical Working

**343-G. Radial Draw Forming of Helicopter Components.** L. Favreau. *Metal Progress,* v. 70, Oct. 1956, p. 88-91.

Radial draw forming equipment is sufficiently versatile that it can be used to fabricate inexpensively many of the complex shapes used in helicopters. (G9)

**344-G. Power Spinning Conical and Tubular Parts.** *Metalworking Production,* v. 100, Sept. 28, 1956, p. 1547-1553.

Advantages and limitations over other metalworking processes; applications; effect on strength, hardness and fatigue of metals; tolerances, finishes and tool costs. (G13, Q23, Q29, Q7, Al, SS, ST)

**345-G.** (French.) **The "Arcair" Process.** G. Doneux. *Revue de la Soudure (Brussels),* v. 12, no. 3, 1956, p. 150-158.

Material is removed from carbon, stainless and refractory steels and nonferrous alloys by melting with an electric arc maintained with a carbon graphite electrode and blowing it away with compressed air. Technological study of the process and applications. (G22)

**346-G.** (Russian.) **The Effects of Cold Working on the Drawing Properties of Sheet Metal.** A. V. Altykis and L. A. Shofman. *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1956, p. 37-42.

The stamping and deep drawing properties of sheet metals after cold working and after annealing. Comparison and application of the methods. (G3, G4, J23)

**347-G.** (Russian.) **The Effect of the Grinding Procedure on Development of Channels on Porous Chromium.** A. A. Mikhailov. *Vestnik Mashinostroeniia,* v. 36, no. 9, Sept. 1956, p. 52-56.

Experimental data on the influence of various factors in grinding metal parts prior to chromium plating on the extent of the channel network on the porous chromium coating. Number of channels increases with the force applied in the grinding. (G18, L17, Cr)

**348-G. What Causes Grinding Stress?** John Harrington. *American Machinist,* v. 100, Oct. 22, 1956, p. 124-126.

Causes and elimination of high temperatures generated at the workwheel point of contact which produce stresses of considerable magnitude. (G18, Q25)

**349-G. The Scale Effect in the Cup Drawing Test.** J. F. Wallace. *Iron and Steel Institute, Journal,* v. 184, Oct. 1956, p. 144-148.

Specification of the drawing performance of sheet metals by this test discussed with particular reference to cup diameter, sheet thickness and blankholder load. (G4)

**350-G. Casting Factors Affecting Machinability of Gray Iron,** Edward A. Loria. *Western Machinery and Steel World,* v. 47, Oct. 1956, p. 96-100.

Influence of pouring temperatures, mold conditions and inoculation practice on machinability. (G17, E general, CI)

## H
## Powder Metallurgy

**139-H. Which Metal Powder Part?** Robert Talmage, William J. Doelker and Carl G. Johnson. *Materials & Methods,* v. 44, Oct. 1956, p. 116-117.

Discusses intermediate density, high density and infiltrated iron powder parts. Presentation affords a direct comparison of the materials for a given application. (H general, Fe)

**140-H. The Fundamental Properties of Metals and Powder Metallurgy.** H. W. Greenwood. *Metallurgia,* v. 54, no. 324, Oct. 1956, p. 187-188.

Improvement in the properties, particularly ductility, of certain metals as small amounts of impurities are removed. Beneficial effects of grain coatings; production of alloys in powder form. (H general, Al, Mg, Zr, Ti, Fe)

**141-H. Particle Size Determination in Powder Metallurgy. A General Review of Available Methods.** L. A. Phelps. *Metallurgia,* v. 54, no. 324, Oct. 1956, p. 197-200.

Basic principles underlying the methods for obtaining size range of raw materials and its distribution within that range. (H11)

**142-H. Sintering Furnace Maintenance.** (Digest of "Some Aspects of Sintering Furnace Maintenance", by George Otto, presented at the annual meeting of the Metal Powder Assoc., April, 1956). *Metal Progress,* v. 70, Oct. 1956, p. 194.

Burn-off twice weekly, slightly lowered voltage and other changes were made to improve element life in a furnace used to sinter bronze bearings. (H15, Cu)

**143-H.** (Dutch.) **Powder Metallurgy of Nonferrous Metals, Especially of Copper and Copper Alloys.** W. G. R. de Jager. *Metaalinstituut T. N. O.,* no. 44, Sept. 1956, 36 p.

Powder production and properties, mixing, forming and sintering procedures. (H general, EG-a, Cu)

**144-H.** (German.) **Investigation of "Nowotny" Phases.** R. Kieffer, F. Benesovsky and B. Lux. *Planseeberichte für Pulvermetallurgie,* v. 4, no. 2, Aug. 1956, p. 30-36.

Preparation of metal silicides, effects of additions of boron, nitrogen, carbon and oxides on various metal-silicon systems. (H general, Si)

**145-H. Titanium Nitride: Its Preparation and "Hard-Metal" Properties.** I. C. Kraitzer and I. E. Newnham. *Australian Journal of Applied Science,* v. 7, Sept. 1956, p. 215-223 + 1 plate.

Compound is produced from titanium tetrachloride and ammonia by a simple low-cost process. When mixed with suitable alloying elements the powder can be compacted and sintered to give products with typical "hard-metal" properties. (H general, Ti)

**146-H.** (Czech.) **Sintering of Tantalum.** Jiri Vacek. *Hutnické Listy,* v. 11, no. 9, Sept. 1956, p. 522-529.

Preparation, properties and applications. Tantalum powder metallurgy, especially sintering, studied. (H15, Ta)

**147-H.** (French.) **The Effect of Repeated Cycles Existing on Either Side of the Transformation Points $A_3$ on the Structure of Rods of Fritted Iron**

**and of Compact Iron.** Georges Cizeron and Paul Lacombe. *Comptes Rendus,* v. 243, no. 14, Oct. 1, 1956, p. 951-953.

Macroscopic excrescences, dislocations and pores developed on samples by transformation from $\alpha$ to $\gamma$ iron. (H general, N6, Fe)

**148-H. (Polish.) Sintered Magnets of Al-Ni Type.** W. Rutkowski and S. Stolarz. *Prace Instytutow Ministerstwa Hutnictwa,* 1956, no. 3, p. 155-161.

Density, linear contraction, hardness, magnetic properties, coercive intensity and magnetic remanence determined in permanent magnets prepared with and without a protective atmosphere. (H general, P16, Fe, Ni, Al)

**149-H. (Russian.) Factors Influencing the Normal Setting of Metal Powder During Sintering.** I. M. Fedorchenko. *Zhurnal Tekhnicheskoi Fiziki,* v. 26, no. 9, Sept. 1956, p. 2067-2075.

Investigation of changes in volume during sintering of metal powders. Effect of oxide films, gases and phase transformation. (H15)

**150-H. (Russian.) Sintering of Multiphase Solids. I. Sintering Between Heterogeneous Grains. II. Sintering of Compressed Powder Mixtures. Effect of Concentration on Shrinkage.** B. Ia. Pines and N. I. Sukhinin. *Zhurnal Tekhnicheskoi Fiziki,* v. 26, no. 9, Sept. 1956, p. 2086-2107.

Sintering of different grains and their surface tension. Kinetics of the sintering process. Shrinkage and volume concentration in the mixtures: copper and iron; copper and molybdenum; copper and tungsten; copper and nickel. (H12, Cu, Fe, Mo, W, Ni)

**151-H. Powder Metallurgy. III. Principal Processes Used in Manufacture of Powders.** J. F. C. Morden. *Metal Industry,* v. 89, Oct. 19, 1956, p. 329-332.

Twelve methods. (H10, H11)

## J
## Heat Treatment

**264-J. Gas Carburising by the "Homocarb" Process.** D. A. Colwell. *Australasian Engineer,* v. 48, Aug. 1956, p. 60-63.

Construction and use of furnace for carburizing mass-produced parts. Fixtures, carburizing media, general considerations. (J28)

**265-J. Metallurgical Aspects in the Design and Operation of a New Continuous Annealing Line. II.** A. F. Mohri. *Blast Furnace and Steel Plant,* v. 44, Oct. 1956, p. 1175-1178.

Heat treating experiments carried out to determine maximum quenching temperature for low-carbon steels. (J23, J26, CN)

**266-J. Recent Developments in Vacuum Heat Treating Furnaces.** Roger R. Giler. *Industrial Heating,* v. 23, Oct. 1956, p. 2038 + 7 pages.

Early problems in refining titanium, resultant design and accomplishments of inert-atmosphere electric furnaces. (J23, C25, Ti)

**267-J. Practical Aspects and Methods of Carbon Control in Heat Treatment.** Wilson T. Groves. *Industrial Heating,* v. 23, Oct. 1956, p. 2060 + 10 pages.

Effect of surface carbon concentration on wear and fatigue life; control of concentration. (J28, Q9, Q7, AY)

**268-J. Modify 12 Pct Cr Steels for Better Properties.** Paul Shahinian and J. R. Lane. *Iron Age,* v. 178, Oct. 25, 1956, p. 108-112.

A single forged heat was subjected to variations in austenitizing temperature, cooling rate and tempering, giving data useful in developing metallurgically superior grades (J22, J26, J29, Q general, SS)

**269-J. Typical Heat Treatments for Wrought Aluminum Alloys.** *Materials & Methods,* v. 44, Oct. 1956, p. 139.

Table includes annealing, solution heat and precipitation heat treatment data. (J general, Al)

**270-J. Selection of Heat Treating Process and Equipment.** E. J. Pavesic and R. T. Sinnott. *Metal Progress,* v. 70, Oct. 1956, p. 83-85.

Some factors to be considered in deciding between batch and continuous heat treating equipment. (J general)

**271-J. Annealing of Cold-Worked Copper by Electron Irradiation.** C. J. Meechan. *North American Aviation, Inc. (U. S. Atomic Energy Commission),* NAA-SR-1654, Sept. 1956, 15 p.

Wires were cold worked at room temperature to 15% reduction in area and irradiated at various temperatures. Residual resistivity decreased with exposure at temperatures above 100° C. (J23, M26, Cu)

**272-J. Nitriding for Case Hardening.** Howard E. Boyer. *Steel Processing,* v. 42, Oct. 1956, p. 573, 589.

Combination of nascent nitrogen with the alloys which are in solid solution and precipitation of these alloy nitrides which are then insoluble in the matrix comprises the two nitriding steps. (J28, N7, AY)

**273-J. Mass Marquenching. Speeds Carburizing of Truck Transmission Parts.** *Steel Processing,* v. 42, Oct. 1956, p. 585-588.

Hardening is from "inside-out" and for this reason is an ideal treatment for such heavily loaded parts as truck gears. Modernization of furnace line is discussed in addition to high-alloy trays and furnace parts and their importance to this new method. (J26, J28)

**274-J. Some Thoughts on Spring Heat Treatment and Finishing.** E. Mitchell. *Wild-Barfield Heat Treatment Journal,* v. 5, Sept. 1956, p. 2-7.

Aspects of hardening, tempering and austempering small carbon steel springs, including effects of good and bad treatment. (J general, CN)

**275-J. (French.) Surface Hardening by High-Frequency Induction and Application in European Industry.** M. Labrousse. *Métallurgie et la Construction Mécanique,* v. 88, no. 9, Sept. 1956, p. 725-726, 729-731.

Technique, surface structure changes, use on a production line basis, comparison of contour hardening in the U.S.A. and France. (J2)

**276-J. (Russian.) X-Ray Study of the Mechanism of Thermal Action on Plastically Deformed Metals.** Iu. S. Terminasov and G. A. Feklistov. *Izvestiia, Akademii Nauk SSSR, Seriia Fizicheskaia,* v. 20, no. 6, June 1956, p. 695-699.

Manner in which distortions of the crystal lattice are removed by heat treatment, and minimum annealing times and temperatures for certain metals. (J23, M26, ST, Cu, Al)

**277-J. Low Cost, Mechanized Selective Heat Treatment.** K. M. Yeager. *Canadian Metals,* v. 19, Oct. 1956, p. 48, 50, 52.

Yoke-type axle shafts were heat treated to selectively harden 3 in. of the yoke end. (J26, CN)

**278-J. Continuous Annealing of Steel Plate Strip.** Horace Drever. *Iron and Steel Engineer,* v. 33, Oct. 1956, p. 109-111.

Chief advantage is uniformity of product. Line speeds are still slow but are increasing. A major problem is cooling. (J23, ST)

**279-J. Electromatic Oil Tempered Wire.** George A. Sweitzer. *Wire and Wire Products,* v. 31, Oct. 1956, p. 1155-1159, 1278-1279.

With Trauwood unit there is an electrical resistance heating cycle and an arrested quenching cycle for producing oil tempered wire for steel springs. Process produces a finer grained, tougher microstructure with high physical properties. (J general, T7, CN)

**280-J. (German.) New Method of Calculation for Heat Field Detection During Induction Heating of Metals.** H. Lachner. *Metall,* v. 10, no. 19-20, Oct. 1956, p. 930-932.

New method, based on theoretical and experimental work, presented in curves and formulas. (J2, S16)

**281-J. (Russian.) On the Application of Various Types of End-Quench Hardenability Tests.** A. A. Gol'denberg. *Zavodskaia Laboratoriia,* v. 22, no. 9, Sept. 1956, p. 1063-1065.

The standard end-quench test is found most suitable for shallow and medium hardening steels. (J26, ST)

**282-J. New Heat Treatments Improve Beryllium Copper.** J. T. Richards. *Iron Age,* v. 178, Nov. 8, 1956, p. 95-98.

Advantages include improved strength, better conductivity, resistance to fatigue and an over-all superior material. (J general, Be, Cu)

**283-J. Heat Treatment and Mechanical Properties of Ti-Mo Alloys.** F. C. Holden, H. R. Ogden and R. I. Jaffee. *Journal of Metals, v.* 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Sec. 2, Oct. 1956, p. 1388-1393.

Extensive $\alpha$-$\beta$ annealing treatments are required to reach equilibrium at lower annealing temperatures. Soft, ductile $\beta$ phase can be formed on quenching. The formation of strain-induced martensite in retained $\beta$ over the composition range of 8 to 16% molybdenum results in low yield-to-ultimate strength ratios, high uniform elongation, and high resistance to impact. (J23, J26, Q general, Ti, Mo)

**284-J. (Russian.) Electron Microscope Investigation of an Al-Cu Alloy After High-Temperature Aging and Annealing.** N. N. Buinov and O. D. Shashkov. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 83-86.

A study of the mechanism of transformation of metastable phases into a stable phase in aluminum-copper alloys. A connection is established between the orientations of the lattices of the phases. (J23, N9, Al, Cu)

**285-J. (Russian.) Thermal Parameters in Induction Heating of Pressure-Treated Metals.** M. G. Kogan. *Metallovedenie i Obrabotka Metallov,* no. 9, Sept. 1956, p. 49-56.

An analytical treatment of the problem of calculating proper thermal parameters of induction heating from the given initial technological parameters of the treated metal. Appropriate formulas derived. (J2)

**286-J.** (Russian.) **Practical Experience With Vacuum Annealing of Hot Rolled Transformer Steel.** N. F. Dubrov. *Stal'*, v. 16, no. 9, Sept. 1956, p. 811-815.

Advantages of annealing transformer steel in vacuum over that in tunnel kilns. Vacuum annealing results in better magnetic and plastic properties and an improved surface. (J23, P16, Q23, AY)

**287-J.** (Russian.) **Nitriding of Structural Steels.** E. M. Morozova and A. P. Skuzovatova. *Stanki i Instrument*, v. 27, no. 9, Sept. 1956, p. 25-27.

Experimental nitriding of steels alloyed with chromium, chromium and silicon, and chromium and zirconium. Nitriding increases surface hardness and wear resistance. (J28, Q29, Q9, AY)

**288-J.** (Book.) **Induction Heating Practice.** D. Warburton-Brown. 192 p. 1956. Philosophical Library, Inc., 15 E. 40th St., New York 16, N. Y. $10.00.

A practical handbook on the application of the high-frequency induction heating process to brazing, soldering, hardening, annealing, tempering and other heating requirements in engineering. (J2, K7, K8)

# K

## Joining

**522-K. Welding High-Pressure Pipe Lines: A New Automatic Pressure Butt-Welding Process.** J. E. Burton and J. N. Bradley. *Engineering*, v. 182, Sept. 28, 1956, p. 399-404.

Automatic pressure welding process for mild and low-alloy steel pipes in which the plasticity of the steel is allowed to control its own welding cycle. (K2, AY)

**523-K. Automatic Submerged-Arc Welding of Alloy Steel.** R. A. Wilson. *Metal Progress*, v. 70, Oct. 1956, p. 104-107.

Welds with properties that match those of the parent alloy steel can be made using mild steel wire and special fluxes which supply the alloying elements required. (K1, AY)

**524-K. How to Weld Gas-Turbine Alloys.** A. L. Cooper and H. L. Printz. *Metalworking Production*, v. 100, Oct. 12, 1956, p. 1642-1647.

Materials and techniques used in welding stainless steels and superalloys for gas turbines. (K1, K3, SG-h, SS)

**525-K. Welding and Brazing. A Bibliography of Unclassified Report Literature.** *U. S. Atomic Energy Commission*, TID-3301, July 1956, 32 p.

Materials of interest to nuclear technology. Author, subject, and report-number indexes included. (K general)

**526-K.** (French.) **Present State of Deep Penetrating Technique.** G. Doneux. *Revue de la Soudure (Brussels)*, v. 12, no. 3, 1956, p. 159-166.

A critical survey of the methods used in end-to-end joint welding through deep penetrating electrodes. A theoretical study of angle joint welding. Various curves and tables. (K1)

**527-K.** (German.) **Prevention of the Formation of Martensite in Electric Arc Welding.** Fritz Dechner and Hermann Speich. *Stahl und Eisen*, v. 76, no. 19, Sept. 20, 1956, p. 1249-1251.

Tests are carried out in the weld seam and in the zone affected by the heat, by following up the weld with an annealing burner of appropriate length in a definite distance from the electrode. (K1, N8, ST)

**528-K.** (German and French.) **Joining Aluminum With Other Metals.** E. Zurbrügg. *Aluminium Suisse*, v. 6, no. 5, Sept. 1956, p. 174-180.

Joining in noncorrosive surroundings and with anticorrosive precautions. Joining through clamping or gluing, hard soldering and welding. (K general, Al)

**529-K.** (Hungarian.) **Employing Welding and Heat Treatment for Repairing Machine Tool Castings.** Miklos Cseh. *Ontöde*, v. 7, No. 9, Sept. 1956, p. 197-200.

Welds of gray cast iron must not be harder than the casting itself. Normalizing eliminates detrimental hardness differences. (K1, J24, CI)

**530-K.** (Russian.) **A Study of the Kinetics of Grain Growth and Changes in the Structure and Mechanical Properties in the Weld Area of Low-Alloy Steels.** M. Kh. Shorshorov, G. N. Klebavno and L. S. Gushchina. *Svarochnoe Proizvodstvo*, no. 9, Sept. 1956, p. 1-4.

A method and apparatus for evaluation of the weldability of metals from the change in their mechanical properties and structure in the heat affected zone at any stage of the welding cycle. (K9, AY)

**531-K.** (Russian.) **Testing Electrodes for Welding of High-Quality Steel.** A. A. Erokhin. *Svarochnoe Proizvodstvo*, no. 9, Sept. 1956, p. 4-9.

Test data on a number of electrodes. Best results were obtained with joints welded with medium-alloy electrodes containing chromium, manganese, silicon and 0.1 to 0.2% carbon. (K1, K9, AY)

**532-K.** (Russian.) **Method of Testing Welded Joints for Cracking on Hull Structures of Vessels.** K. G. Nikolaev and B. A. Gololobov. *Svarochnoe Proizvodstvo*, no. 9, Sept. 1956, p. 9-12.

A method of testing weld joints of marine hull structures under simulated conditions of welding. A specially assembled specimen is used. (K9)

**533-K.** (Russian.) **Automatic Welding of Steam Turbine Diaphragms.** L. A. Mel'nikov and Z. L. Klimovitskii. *Svarochnoe Proizvodstvo*, no. 9, Sept. 1956, p. 19-21.

A method and a machine for automatic welding of steam turbine diaphragms. (K1, T25)

**534-K. The Welding of Cr-Mo Low-Alloy Steels for Oil-Industry Equipment.** F. F. Ates, L. Capel and C. P. M. Kijm. *British Welding Journal*, v. 3, Oct. 1956, p. 457-463.

Laboratory investigation of various factors affecting weldability of low alloy steels; the criteria applied. (K9, AY)

**535-K. The Welding of 13% Chromium Steels.** J. A. McWilliam. *British Welding Journal*, v. 3, Oct. 1956, p. 464-468.

Tests were carried out on butt welds in ½-in. and ⅛-in. plate, and also on steel welds; mention is made of the welding of cutlery-quality steel. (K1, SS)

**536-K. The Welding of Spheres and Bullets in situ.** M. J. Noone and W. C. Holliday. *British Welding Journal*, v. 3, Oct. 1956, p. 477-485.

Welded construction of large pressure vessels for storage of gases and liquids. Discusses materials of construction, shop fabrication, erection and preparation, ambient conditions, inspection, stress relieving and methods of testing. (K1, J1, CN, ST)

**537-K. Austenitic Welds in 5% Cr, 0.5% Mo Steel Pipes.** H. G. Geerlings and W. P. Kerkhof. *British Welding Journal*, v. 3, Oct. 1956, p. 469-477.

Advantages and disadvantages. Mechanical properties of welds and influence of service temperature are considered, with attention devoted to heat affected zone between weld metal and parent material. (K1, Q general, AY)

**538-K. The Origin and Distribution of Hydrogen in Steel Weld Metal.** E. J. Millett. *British Welding Journal*, v. 3, Oct. 1956, p. 497-509.

Conditions necessary for the experimental determination of the segregation of hydrogen in weld metal are deduced and suitable apparatus described. (K9, ST)

**539-K. Determining the Size and Rating of Resistance Welding Machines.** H. Kocher and E. Weber. *Brown Boveri Review*, v. 43, no. 7, July 1956, p. 266-271.

Effect of weld quality on dimensioning of machine. Fundamental quantities are electrode pressure, welding current and time. Effect of weld quality on normal and peak load. Power consumption of various designs. (K3)

**540-K. Welding Heavy Sections.** H. J. Nichols. *Canadian Metals*, v. 19, Oct. 1956, p. 30-32.

Structural problems, preheating, automatic and semi-automatic welding, filler wire and flux, substitutes for peening. (K1, AY)

**541-K. Power Hand Grinder Sparks New Soldering Technique.** *Canadian Metals*, v. 19, Oct. 1956, p. 34, 36.

New technique makes possible the soldering of materials like glass, aluminum, stainless steel and ceramics and is expected to replace the more expensive ultrasonic method. (K7)

**542-K. Developments in Mechanized Welding in the Aero-Engine Industry.** F. G. C. Sandiford. *Institution of Mechanical Engineers, Proceedings*, v. 170, no. 4, 1956, p. 157-183 + 4 plates.

Illustrated review of a wide range of applications of fusion and resistance welding in current use. (K1, K3)

**543-K. Weld Stronger Joints in Low-Alloy Steels.** R. D. Libert. *Iron Age*, v. 178, Oct. 18, 1956, p. 135-138.

Flash welding experiments with selected high-strength steels heat treated to 280,000-psi. levels. (K3, AY)

**544-K. Large-Scale Welded Assemblies.** R. H. Warring. *Machinery Lloyd (Overseas Ed.)*, v. 28, Oct. 13, 1956, p. 81-83.

Special techniques and equipment used in fabricating the largest aircraft wing tanks ever constructed. Electrical resistance welding was the principal joining method. (K3)

**545-K. How to Weld Aluminum.** Charles Bruno. *Modern Metals*, v. 12, Oct. 1956, p. 38, 40, 42.

Welding processes, welding characteristics of alloys, temperature requirements, design of fixtures, weld penetration, and other factors. (K1, Al)

**546-K. Problems Involved in Spot Welding Titanium to Other Metals.** Frank W. McBee, Jimmy Henson and L. R. Benson. *Welding Journal*, v. 35, Oct. 1956, p. 481s-487s.

Properties and problems of spot welding commercially pure titanium to stainless steel and several other

metals. General information concerning the nature of these welds. (K3, SS, Ti)

**547-K. Fabrication and Welding of Arc-Cast Molybdenum.** R. E. Monroe, N. E. Weare and D. C. Martin. *Welding Journal*, v. 35, Oct. 1956, p. 488s-498s.

The effects of variation in composition and fabrication procedures on the ductility of fusion weldments studied for titanium-neutralized and carbon-deoxidized molybdenum. (K1, Q23, Mo)

**548-K. Thermal Stability of Cold Butt Welds in Copper and Aluminum.** W. H. Bruckner and J. H. Sayles. *Welding Journal*, v. 35, Oct. 1956, p. 501s-505s.

Surveys properties of cold welds and indicates the conditions under which these welds have the most useful application. (K5, Q general, Cu, Al)

**549-K. Wettability of Steel With Pure Silver and Various Silver-Brazing Alloys.** Nikolajs Bredzs. *Welding Journal*, v. 35, Oct. 1956, p. 508s-520s.

Experimental program with silver alloys containing strong deoxidizers indicates new possibilities for development of self-fluxing, airproof brazing alloys. (K8, Ag)

**550-K. Fusion Welding Zirconium for a Nuclear Reactor.** Bruce L. Baird. *Welding Journal*, v. 35, Oct. 1956, p. 1007-1014.

Study indicated that weld bead porosity can be caused by poor joint cleaning, but not poor inert-gas shielding. Welds equal in ductility to the base metal can be made using the proper combination of inert-gas shielding and chill. (K1, Zr)

**551-K. Portable Reactor Has Welded Gold Lining.** *Canadian Metals*, v. 19, Oct. 1956, p. 26-28.

Gold is used to make lining for stainless steel reactor fuel tank. Wooden axe handle is used to form the gold shell. (K1, T25, Au)

**552-K. Use Resistance Welding for Ultra-Thin Stainless Tubing.** *Industry & Welding*, v. 29, Nov. 1956, p. 65-66.

New resistance welding techniques developed for fabricating 0.002-in. thick stainless steel for aircraft heat insulators. (K3, SS)

**553-K. Mig Process and Cutting Unit Weld Irregularly-Shaped Joints.** *Welding Engineer*, v. 41, Nov. 1956, p. 54-56.

Welding gun, weld metal deposition, magnetic follower, drive pulleys, craters, hot shortness, tolerances, structural changes. (K1)

**554-K. (Russian.) Near-Seam Cracks and Mechanical Properties of Welded Electro-Slag Joints in Medium Alloy Steels.** A. M. Makara, V. F. Grabin and I. V. Novikov. *Avtomaticheskaia Svarka*, v. 9, no. 4, July-Aug. 1956, p. 1-21.

Avoiding cracks in the welded steel seam by slag-welding to obtain joints of high mechanical properties. (K1, ST)

**555-K. (Russian.) Certain Metallurgical Peculiarities of Electro-Slag Welding.** D. A. Dudko and I. N. Rublevskii. *Avtomaticheskaia Svarka*, v. 9, no. 4, July-Aug. 1956, p. 22-29.

Transfer of carbon, manganese, silicon and phosphorus from the electrode wire; effect of atmospheric oxygen. (K1, ST)

**556-K. (Russian.) Fluxes for Electro-Slag Welding.** V. V. Podgaetskii. *Avtomaticheskaia Svarka*, v. 9, no. 4, July-Aug. 1956, p. 30-49.

Chemical composition, electroconductivity and viscosity of proposed slags. (K1, ST)

**557-K. (Russian.) Application of Radioactive Isotopes for Control of the Metal Bath in Electro-Slag Welding.** Iu. D. Gupalo, B. A. Movchan and R. M. Shirokovskii. *Avtomaticheskaia Svarka*, v. 9, no. 4, July-Aug. 1956, p. 67-69.

Scheme and method of application. (K1, S19, ST)

**558-K (Russian.) Contact-Slag Welding of Large Cross-Sections.** D. A. Dudko and I. K. Pokhodnia. *Avtomaticheskaia Svarka*, v. 9, no. 4, July-Aug. 1956, p. 70-75.

New simple, high-productive method for cross sections of 10,000 to 20,000 sq. mm. using a low power generator. (K1, ST)

**559-K. (Russian.) Contact Welding of Piping for Boilers of Especially High Characteristics.** A. S. Gel'man and E. S. Slepak. *Metallovedenie i Obrabotka Metallov*, no. 9, Sept. 1956, p. 41-49.

Data on welding for super-high-pressure boilers. Welding of pipe of austenitic steel; welding to pipe of pearlitic steel. (K3, AY)

**560-K. (Russian.) Some Technological Aspects of Automatic Flux-Shielded Welding of Lap-Joined Sheets 2.5 to 6 Mm. Thick.** A. G. Mazel and N. A. Sluchanko. *Stroitelstvo Predpriiatii Neftianoi Promyshlennosti*, v. 1, no. 7, Sept. 1956, p. 14-16.

Experimental data and theoretical considerations on the optimum procedures for arc welding lap-joined sheets with direct current, reverse polarity. (K1, ST)

# L
# Cleaning, Coating and Finishing

**701-L. Influence of Copper Ions on Adherence of Vitreous Coatings to Stainless Steel.** D. G. Moore and A. G. Eubanks. *American Ceramic Society, Journal*, v. 39, Oct. 1956, p. 357-361.

Copper ions produced significant increase in adherence on both pickled and sandblasted surfaces. Effect of the copper decreased with increased firing temperature and increased firing time for pickled specimens. (L27, Cu, SS)

**702-L. Selection of Hard Facing Materials for Lowest Maintenance Cost.** N. D. Berrick. *Australasian Engineer*, v. 48, Aug. 1956, p. 47-53.

Structure and properties of materials, types of hard facing rods and electrodes, service performance of hard faced parts. (L24)

**703-L. Chromium Plating.** D. J. Fishlock. *Chemistry and Industry*, no. 37, Sept. 22, 1956, p. 977-980.

Review of electroplating procedures, methods for producing surface finishes with desired physical and chemical characteristics, factors influencing bright plating. (L17, Cr)

**704-L. Permeation of Gases Through Nickel Deposits. I. Determination of the Intrinsic Permeability of Nickel Deposits to Gases.** D. T. Ewing, J. Martin Tobin and D. Gardner Foulke. *Electrochemical Society, Journal*, v. 103, Oct. 1956, p. 545-548.

Values were obtained for permeability constants of nickel electrodeposits to hydrogen and helium with a good degree of reproducibility. Pores present in sound nickel electrodeposits were extremely small. (L17, Ni)

**705-L. New Design of an Electrolytic Cell for the Study of Electroplating Phenomena.** Roger Gilmont and Robert F. Walton. *Electrochemical Society, Journal*, v. 103, Oct. 1956, p. 549-552.

Geometrical shape of a new electroplating cell was deduced in which the current density along the cathode is linear and can be calculated directly from the total current and voltage of the cell. (L17)

**706-L. Electron Microscope Studies of Copper Anodes Obtained in Sulfate and Cyanide Baths.** Shinzo Okada, Saburo Magari and Kentaro Katsui. *Electrochemical Society, Journal*, v. 103, Oct. 1956, p. 553-557.

Studies revealed that appearance of the microstructure of the surface formed during electrolysis varied with the electrolytes, but the same crystal planes were developed in both baths and in a number of etching solutions. (L17, M27, Cu)

**707-L. Electron Microscope Studies on Copper Electrodes in Sulfate Bath Containing Addition Agent.** Shinzo Okada, Saburo Magari and Kentaro Katsui. *Electrochemical Society, Journal*, v. 103, Oct. 1956, p. 557-561.

Thiourea gave the smoothest deposits, in which the facets of the deposit were parallel to the (120) planes of the base crystal. (L17, M27, Cu)

**708-L. Plating in Pyrophosphate Baths.** John Starr. *Industrial Finishing*, v. 9, Sept. 1956, p. 80-82.

Equipment, composition of plating electrolyte, processes and procedures, plating speed table. (L17, Ni, Cu)

**709-L. Diffusion of Hydrogen Through Ceramic Coatings.** *Industrial Heating*, v. 23, Oct. 1956, p. 2191-2192, 2194.

Study reveals that the ceramic reduces the hydrogen flow by a factor of about 20. Reported differences in the creep rates of bare metals in hydrogen and in air, and attributed this difference to the oxide layer formed on metal. (L27, Q3, N1, Ni)

**710-L. Leveling Nickel.** D. Gardner Foulke. *Metal Finishing*, v. 54, Oct. 1956, p. 52-56.

Effect of variables such as current density, temperature, pH and agitation upon the degree of leveling obtainable. (L17, Ni)

**711-L. Cleaning Metals and Alloys.** C. B. F. Young. *Metal Finishing*, v. 54, Oct. 1956, p. 57-60, 65.

Surface contaminants, polishing and buffing compounds, ultrasonic cleaning, removal of surface films. (To be continued.) (L10, L12)

**712-L. Barrel Plating Equipment.** J. B. Mohler. *Metal Finishing*, v. 54, Oct. 1956, p. 61-65.

Plating costs, typical operating sequence, recent developments, automatic plating, shape and size of parts. (L17)

**713-L. Surface Treatment and Finishing of Light Metals. XI. Pt. 2, Properties of Anodic Coatings.** S. Wernick and R. Pinner. *Metal Finishing*, v. 54, Oct. 1956, p. 66-69.

Corrosion resistance, effect of anodizing, mechanical properties. (L19, R general, EG-a)

**714-L. Science for Electroplaters. XVIII. Electrolytes.** L. Serota. *Metal Finishing*, v. 54, Oct. 1956, p. 71-72.

Current flow through electrolytes, changes in conductivity, Faraday's laws. (To be continued.) (L17)

**715-L. Finishes for Aluminum Alloys. I. Electrolytic or Anodic Coatings.** Walter E. Pocock. *Metal Progress,* v. 70, Oct. 1956, p. 75-78.

Anodizing increases corrosion resistance and improves appearance. Various processes and properties of resultant coatings. (L19, Al)

**716-L. Developments in Sprayed Metal Coatings.** Herbert S. Ingham. *Metalworking Production,* v. 100, Sept. 21, 1956, p. 1521-1525.

Advances in the design of powder spray guns now permit economical spraying of metal alloys and ceramic materials. Available spray guns are compared; fusing and other properties of the alloys are discussed. (L23)

**717-L. Practical Aspects of Cadmium Plating.** John Kosmos. *Plating,* v. 43, Oct. 1956, p. 1235-1240.

Composition of plating baths for different plating procedures and specifications. (L17, ST, Cd)

**718-L. Notes on Post-Treatment for HAE Coatings.** Harry Salmon and Fielding Ogburn. *Plating,* v. 43, Oct. 1956, p. 1241-1243.

Developed procedure for a dichromate-bifluoride post-treatment. Recommends that treated panels remain under ambient atmospheric conditions for three days if they are to be subjected to salt spray tests. (L19, Mg)

**719-L. Plastisols. Tough Protective Coatings for Plating Equipment.** D. R. Meserve. *Plating,* v. 43, Oct. 1956, p. 1244-1247.

Coating service, exposure tests, coating processes, comparative costs. (L26, L17)

**720-L. Temporary Protective Coatings for Metals. I. Lanolin-Containing Materials.** E. Strong. *Product Finishing,* v. 9, Sept. 1956, p. 50-58, 116.

Reviews early rust preventives and methods of application; new Lanolin applications and advantages over old methods. (L26, R10, ST)

**721-L. Electroless Nickel Plating.** D. J. Fishlock. *Product Finishing,* v. 9, Sept. 1956, p. 61-70.

Details of the process and the deposit produced and possible applications. (L14, Ni)

**722-L. Techniques for Surface Treatment of Aluminum.** Henry Walker. *Products Finishing,* v. 21, Oct. 1956, p. 44 + 6 pages.

Electrolytic and chemical polishing, anodizing, soft and enamel anodizing, sealing. (L general, Al)

**723-L. Barrels Tumble $30,000 From Stampings Finishing Costs.** Kenneth D. Higgins. *Tooling and Production,* v. 22, Oct. 1956, p. 103-105.

Modern equipment and new techniques employed in a progressive barrel finishing system. (L10, ST)

**724-L.** (Finnish.) **Protective Coatings for Industrial Atmospheres. II.** Veikko Tolvanen. *Teknillisen Kemian Aikakauslehti,* v. 13, no. 14, Sept. 1956, p. 470, 473-474, 476.

Binders, systems of paint layers, criteria for the selection of protection for structures under different circumstances, maintenance and inspection of coatings. (L26)

**725-L.** (French.) **Sand Blast and Peening of Light Alloys.** Francois Flushin. *Corrosion et Anticorrosion,* v. 4, no. 8, Sept. 1956, p. 276-280.

A study of both processes for surface preparation before anticorrosive coating and of the choice between various types of sand and shots. (L10, G23, EG-a)

**726-L.** (French.) **Phosphatization and Anticorrosion.** Roger Lagarde. *Corrosion et Anticorrosion,* v. 4, no. 8, Sept. 1956, p. 289-296.

The principle of anticorrosive phosphatization, the deep and light processes, types of coating, and application of the principle to nonferrous metals. (L14, EG-a)

**727-L.** (French.) **Improving Oxidation and Wear Resistance Through Nonelectrolytic Deposition of Nickel.** A. Portalupi and E. Melgara. *Métallurgie et la Construction Mécanique,* v. 88, no. 9, Sept. 1956, p. 747-749, 751, 753.

Chemical nickel plating compared to electrolytic process. Better protection of edges by chemical coating. (L14, Ni)

**728-L.** (German.) **Studies of the Mechanism of Brightening the Surface of Aluminum and Aluminum Alloys. I.** F. Baumann and H. Ginsberg. *Aluminium,* v. 32, no. 10, Oct. 1956, p. 643-648.

Disintegration of aluminum crystals in corrosive media; conditions obtained during attack by a special brightening solution; influence of trace elements. (L12, Al)

**729-L.** (German.) **Applications of Ultrasonics in Surface Treatment of Metals. Cleaning by Means of Piezo-Oscillations.** P. Wenk. *Metalloberfläche,* v. 10, no. 9, Sept. 1956, p. 257-260.

Methods and equipment using a frequency of 20 kc. per sec. (L10)

**730-L.** (German.) **Cleaning With Ultrasonic Devices.** A. Graul. *Metalloberfläche,* v. 10, no. 9, Sept. 1956, p. 260-262.

Ultrasonic waves are applied for cleaning large items in a liquid medium. (L10)

**731-L.** (German.) **Problems of Ultrasonic Application in Surface Treatment of Metals.** K. Frölich. *Metalloberfläche,* v. 10, no. 9, Sept. 1956, p. 262-265.

Ultrasonics in galvanic bath, cleaning with ultrasonics, application of ceramic and quartz transducers, use of vacuum. (L10)

**732-L.** (Russian.) **Hydraulic Abrasive Blasting of Metal Parts.** N. G. Markov, F. V. Kisliakov and M. M. Trukhachev. *Vestnik Mashinostroeniia,* v. 36, no. 9, Sept. 1956, p. 56-57.

Describes a machine designed for treating metallic surfaces with liquids carrying an abrasive material. The treatment is claimed not only to be free from the usual defects of other machining methods, but also to improve the fatigue strength and corrosion resistance of the part treated. (L10, G17)

**733-L.** (Spanish.) **High Temperature Aluminizing of Steel.** Justo Ferrer Flotats. Paper from "XXVIII Congreso Internacional de Quimica Industrial". v. I. Saez, p. 343-347.

Study of aluminum fusion coating. Coating is thinner and offers better resistance to corrosion and to oxidation at temperatures above 250° C. (L16, Al)

**734-L.** (Spanish.) **Anticorrosive Electrolytic Coating of Iron and Steel in Precision Machinery.** S. Terol Alonso and C. Fernandez de Garcia Andrade. Paper from "XXVIII Congreso Internacional de Quimica Industrial". v. I. Saez, p. 376-381.

A study of the anticorrosive behavior of electrodeposited metals—alone or in combination—on precision parts leads to selecting the cadmium-nickel system, with chromium or rhodium, as the best protection in humid, salt atmospheres. (L17, R3, Cd, Ni, Cr, Rh)

**735-L. Vacuum Metallizing in a Custom Shop.** Allan S. Kothe, *Industrial Finishing,* v. 32, Oct. 1956, p. 56 + 5 pages.

Modern equipment makes process practical and permits the coating of any nonporous solid with aluminum, gold, copper, iron, selenium, nickel and copper alloys. (L25)

**736-L. Glass on Aluminum.** E. A. Farrell. *Modern Metals,* v. 12, Oct. 1956, p. 66 + 8 pages.

Technique is expected to open new markets for both the process and the metal. Details of method, advantages and limitations, present and potential applications. (L27, Al)

**737-L. Hot Dip Wire Aluminizing Processes and Alloys.** J. D. Sprowl. *Wire and Wire Products,* v. 31, Oct. 1956, p. 1160-1163, 1273-1277.

Requirements for successful aluminizing, procedures and equipment, aluminizing alloys, comparison with galvanizing. (L16, Al)

**738-L. Continuous Production Electroplating of Tin on Copper Wire Using Alkaline Potassium Stannate Bath.** M. K. Schurter and R. T. Gore. *Wire and Wire Products,* v. 31, Oct. 1956, p. 1201 + 5 pages.

Process layout and operation; comparison with hot-dip method. (L17, Sn)

**739-L.** (German.) **Investigation of Secondary Structure of Anodic Deposits of Aluminum by Means of Dye Absorption. I. Overlapping Main Deposit Layers.** Th. Skulikidis, S. Karalis and P. Mentojiannis. *Kolloid-Zeitschrift,* v. 149, no. 1, Oct. 1956, p. 6-10.

Detection of structures by means of organic dyestuff in both. (L19, M23, Al)

**740-L.** (German.) **Titanium Coating of Metals and Ceramics.** M. E. Straumanis and A. W. Schlechten. *Metall,* v. 10, no. 19-20, Oct. 1956, p. 901-909.

New methods of titanium coating in melted salt containing a titanium-dispersion. (L14, Ti)

**741-L.** (Russian.) **Supertension in Electrolytic Deposition of Metals, and the Zero Points.** L. I. Antropov. *Uspekhi Khimii,* v. 25, no. 8, Aug. 1956, p. 1043-1056.

Present state of the problem. (L17)

**742-L.** (Russian.) **Anodic Dissolution of Ferrochromium in Solutions of Sodium Carbonate and Sodium Hydroxide.** R. I. Agladze and T. V. Ionatamishvili. *Zhurnal Prikladnoi Khimii,* v. 29, no. 9, Sept. 1956, p. 1365-1372.

A study of the dependence of anode yields of chromium on the concentration of sodium carbonate. Yield reaches a maximum in the range from 106 to 212 g. per liter. Advantages of sodium hydroxide over sodium carbonate. (L19, Fe, Cr)

**743-L.** (Russian.) **The Effect of Chlorine on the Dissolution of the Nickel Anode.** A. V. Pomosov and L. I. Gurevich. *Zhurnal Prikladnoi Khimii,* v. 29, no. 9, Sept. 1956, p. 1372-1377.

The depassivation effect of chlorine ions depends on their concentration in the electrolyte. For concentrations up to 1 gram equivalent per liter, there are three distinct concentration ranges in which chlorine ions have different depassivation effects. (L17, Ni)

**744-L.** (Russian.) **Nonstationary Processes in Electrolysis of Copper and Nickel Solutions.** G. A. Emel'ianenko and V. P. Galushko. *Zhurnal Fizicheskoi Khimii,* v. 30, no. 8, Aug. 1956, p. 1710-1717.

Concentration polarization. Effect of surface-active substances and of

preliminary treatment of cathode surface. (L17, Cu, Ni)

**745-L. Properties, Specifications, Tests and Recommendations for Coal Tar Coatings. I. Hot Applied Coatings.** W. F. Fair, Jr., *Corrosion*, v. 12, Nov. 1956, p. 579-587.

Fundamental properties, long-term service characteristics, specification writing and testing for various kinds of hot applied coal tar enamels. (L26)

**746-L. The Trend of Protective Metal Spraying Practice.** W. E. Stanton. *Corrosion Technology*, v. 3, Oct. 1956, p. 311-313.

Equipment, methods, advantages of mechanical treatment, British facilities. (L23, Zn, Al)

**747-L. Sprayed Aluminium and Zinc in Corrosive Environments.** R. E. Mansford. *Corrosion Technology*, v. 3, Oct. 1956, p. 314-316.

Coatings are produced by atomizing molten metal in a stream of compressed air. The metal is supplied to the spraying pistol either as a wire or a powder and is melted in an oxygen-fuel gas flame. (L23, Al, Zn)

**748-L. Metallized Coatings for Heat Corrosion Protection.** J. R. Franklin. *Corrosion Technology*, v. 3, Oct. 1956, p. 326-327.

The most convenient method of applying a thin layer of aluminum is by metal spraying. Consistent results are readily obtained, and the size of the article presents no difficulty. (L23, Fe, Al)

**749-L. "Kanigen" Chemical Nickel Plating.** G. Gutzeit and E. T. Mapp. *Corrosion Technology*, v. 3, Oct. 1956, p. 331-336.

Method for uniformly coating metals and nonmetals with a layer of hard, corrosion-resistant amorphous nickel-phosphorus alloy. Nonporous coating is hard but relatively brittle, adheres well to most properly pretreated basis materials. (L14, Ni)

**750-L. Choosing the Right Aluminum Coating.** Jack H. Goodyear. *Light Metal Age*, v. 14, Oct. 1956, p. 19-22.

Sulphuric and chromic acid types of anodizing; properties and uses of anodized metals. (L19, Al)

**751-L. Electrolytic and Chemical Polishing.** Pierre A. Jacquet. *Metallurgical Reviews*, v. 1, pt. 2, 1956, p. 157-238 + 16 plates.

Surface state of metal, history, principles, mechanism and techniques of polishing processes, comparison of characteristics of surfaces polished mechanically, electrolytically and chemically. (L12, L13)

**752-L. Addition Agents in Nickel Plating.** Robert B. Fischer and Charles E. Ring. *Plating*, v. 43, Nov. 1956, p. 1338-1341.

Investigates certain phases of the brightening mechanism of addition agents by isolating the effects of the addition agent from the effects of all other conditions and components of the plating bath. (L17, Ni)

**753-L. Barrel-Finishing Principles. Selecting the "Best" Burnishing Barrel.** H. Leroy Beaver. *Products Finishing*, v. 21, Nov. 1956, p. 60-62, 64.

Shape, weight and resistance to permanent deformation of the parts being burnished must always be taken into consideration. Barrel that will exert the maximum of pressure without deforming the parts is most desirable. (L10)

# M

# Metallography, Constitution and Primary Structures

**431-M. The Study of Epitaxy in Thin Surface Films.** D. W. Pashley. *Advances in Physics*, v. 5, Apr. 1956, p. 173-240 + 10 plates.

Account of the electron diffraction evidence concerning the formation of an oriented overgrowth; considers relation of this evidence to existing theories. (M26)

**432-M. Some Physical-Metallurgical Properties of Scandium, Yttrium and the Rare Earth Metals.** Kenneth W. Herrmann, A. H. Daane and F. H. Spedding. *Ames Laboratory (U. S. Atomic Energy Commission)*, ISC-702, Aug. 1955, 92 p.

Crystal structures and precision lattice parameters of these metals were investigated. High-purity metals were examined by powder, single crystal and back reflection X-ray diffraction techniques. (M26, P10, P15, N6, EG-g, Sc, Y)

**433-M. Crystallography and the Phase Rule.** A. R. Ubbelohde. *British Journal of Applied Physics*, v. 7, Sept. 1956, p. 313-321.

Surveys structural changes such as crystal lattice transformations on melting that produce increases of entropy. Attention directed toward pre-transition and pre-melting phenomena; occurrence of smeared or continuous transitions; occurrence of hysteresis. (M26, N general)

**434-M. The Systems Aluminum-Tin and Aluminum-Lead-Tin.** A. N. Campbell and R. Kartzmark. *Canadian Journal of Chemistry*, v. 34, Oct. 1956, p. 1428-1439 + 3 plates.

Solubility of tin in aluminum, between 400 and 645° C., was determined by an isothermal method. Eutectic temperature and composition of this system were determined. (M24, Al, Sn, Pb)

**435-M. The Band Structure of Bismuth.** V. Heine. *Physical Society, Proceedings*, v. 69, no. 439A, July 1956, p. 513-519.

Properties of bismuth and its alloys are considered. Discusses four particular aspects of the observed magnetic properties that make the hypothesis appear plausible. (M25, P16, Bi)

**436-M. Phase Relationships in Magnesium Alloys.** *U. S. Department of Commerce, National Bureau of Standards, Sixth Quarterly Progress Report* 4725, June 1956, 6 p. + 6 plates.

Determined solid solubility boundaries at the magnesium-rich end; identified phase in equilibrium with the magnesium-terminal solid solution; determined extent of two-phase region adjoining the one-phase region; established solidus and liquidus boundaries. (M24, N12, Mg)

**437-M. (English.) A Study of the Strain-Free Cutting of Metal Single Crystals.** Mikio Yamamoto and Jiro Watanabé. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 8, no. 3, June 1956, p. 230-242.

Construction of an etching-cutter; testing of various materials for the string of the cutter; use and comparison with paraffin techniques. (M21, Cu, Fe, Zn, Sn, Al, Ni)

**438-M. (French.) Electrochemical Behavior of Magnesium. pH Tension Equilibrium Diagrams of Systems Mg-$H_2O$, Mg-$CO_2$-$H_2O$ and Mg-$H_3PO_4$-$H_2O$ at 25° C.** J. Van Muylder and M. Pourbaix. *Centre Belge d'Etude de la Corrosion, Rapport Technique*, no. 39, Mar. 1956, p. 1-20.

Free enthalpies of standard formation. Reactions and equilibrium formulas. Interpretation of equilibrium diagrams. Magnesium behavior in presence of carbonates and of phosphates, corrosion, and reactive anodes. (M24, R general, Mg)

**439-M. (German.) Metallographic Preparation of Noble Metal Specimens by Cutting With a Microtome.** Gerhard Reinacher. *Zeitschrift für Metallkunde*, v. 47, no. 9, Sept. 1956, p. 607-613.

Grinding metallographic samples with emery papers can be advantageously replaced by cutting with a suitable microtome. (M21, EG-c)

**440-M. (German.) Etching Tests on Germanium Single Crystals.** Hans Achim Schell. *Zeitschrift für Metallkunde*, v. 47, no. 9, Sept. 1956, p. 614-620.

Crystals drawn vertically with various lattice orientations showed mostly (111)-planes. Development of etch pits was followed using preferential etchant. Density and distribution of dislocations can be compared with such tests. (M21, Ge)

**441-M. (German.) Electron Interference Investigation on Alloys Subject to Separation as a Thin Layer. I. System: Aluminum-Silver. II. System: Aluminum-Copper.** Albert Winkelmann. *Zeitschrift für Metallkunde*, v. 47, no. 9, Sept. 1956, p. 621-631.

In age hardening of the silver alloy the second phase segregates instantaneously from supersaturated solid solution into equilibrium state. In copper alloys the segregation rate rises with diminishing grain size. (M22, Al, Cu)

**442-M. (German.) Electron-Microscopic Investigation of the Structure of Thin Electrolytically Precipitated Metal Layers.** Ludwig Reimer. *Zeitschrift für Metallkunde*, v. 47, no. 9, Sept. 1956, p. 631-636.

Electrodeposited metallic layers removed from metal base lead to better replicas for electron microscope than well-known plastic replicas. Comparison of bright with dark field photographs provides important knowledge about grain size of layers. (M27)

**443-M. (German.) Determination of Fibrous Texture of Wire by Means of a Counter-Tube Goniometer.** Frank Haessner. *Zeitschrift für Metallkunde*, v. 47, no. 9, Sept. 1956, p. 649-652.

Fiber textures are easily investigated by attaching an auxiliary head to a counter goniometer suitable for determining textures of sheet materials. Results with hard drawn and recrystallized aluminum wire. (M23, Al)

**444-M. (German.) Dislocations and Allotropic Transformation. II.** Alfred Seeger. *Zeitschrift für Metallkunde*, v. 47, no. 9, Sept. 1956, p. 653-660.

A comparison based on dislocation theory between plastic deformation of crystals and allotropic transition with special reference to the nucleation problem. (M26, N6)

**445-M. (German.) Electron-Theoretical Investigation of Failures in Metals. III. Effect of Dislocation on the Crystal Density and Related Problems. IV. Electrical Resistance of Dis-**

**locations.** Alfred Seeger and Heinz Stehle. *Zeitschrift für Physik*, v. 146, no. 2, Sept. 1956, p. 217-268.

Effect of plastic deformation on crystal density. Nonlinear mathematical treatment of dislocated structure. (M26, P15)

**446-M.** (Russian.) **Chemical Nature of Tertiary Intermetallic Phases in Magnesium-Copper-Zinc, and Magnesium-Copper-Nickel, Systems.** V. I. Mikheeva and G. G. Bakaian. *Doklady Akademii Nauk SSSR*, v. 109, no. 4, Aug. 1, 1956, p. 785-786.

Comparison of these tertiary systems with the binary system of laves. (M24, Mg, Cu, Zn, Ni)

**447-M.** (Russian.) **Determination of Characteristic Temperatures and Distortions of the Lattice in Several High-Melting Metallic Compounds and Their Solid Solutions.** S. M. Nikolaeva and Ia. S. Umanskii. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 631-635.

Strength of interatomic bond in crystal lattice of titanium carbide. Relation of crystal-lattice distortions, diffusion and microhardness to composition of cobalt-aluminum and nickel-aluminum alloys. (M26, N1, Q29, Ti, Co, Al, Ni)

**448-M.** (Russian.) **X-Ray Study of the Plasticity of Beryllium Single Crystals.** R. I. Garber, I. A. Gindin, V. S. Kogan and B. G. Lazarev. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 639-640 + 2 plates.

Laue diffraction patterns before and after deformation. Dislocations of parts of the single crystal and microtears along slip planes at temperatures from 200 to 800° C. (M26, Q24, Be)

**449-M.** (Russian.) **X-Ray Study of the Quality of Metal Surfaces Prepared by Rapid Machining.** T. Kh. Chormonov. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 703-705.

Relation of depth of propagation of plastic deformations in steel and in brass to rate of machining and feed. Distortions of second and third order are studied. (M26, Q24, G17, ST, Cu)

**450-M. The Titanium-Hydrogen System.** R. M. Haag and F. J. Shipko. *American Chemical Society, Journal*, v. 78, Oct. 20, 1956, p. 5155-5159.

The equilibrium pressure of hydrogen over titanium-hydrogen was measured at 300, 400 and 500° C. Similar measurements were made of titanium-deuterium and titanium-tritium. (M24, N15, Ti)

**451-M. Defects in Germanium Crystals Grown From the Melt.** E. Billig. *British Journal of Applied Physics*, v. 7, Oct. 1956, p. 375-376.

Distribution of etch pits over various parts of a crystal were studied and correlation was obtained with the lifetime of minority carriers and with transistor action. (M26, Ge)

**452-M. X-Ray Scattering by Liquid-Metal Alloys (a Kinetic Approach).** Rufus C. Ling. *Journal of Chemical Physics*, v. 25, Oct. 1956, p. 614-616.

Theory of liquids is extended to the case of liquid mixtures, and a formula for the X-ray scattering is developed. (M22, K, Na)

**453-M. Delayed Yielding in a Substitutional Solid Solution Alloy.** L. A. Shepard and J. E. Dorn. *Journal of Metals*, v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 206, Oct. 1956, p. 1229-1235.

Investigation of the effects of stress and temperature on delayed yielding arising from substitutional atom locking of dislocations in a face-centered-cubic alloy. (M26, Q23, Al)

**454-M. Crystal Structure of Delta-Prime Plutonium and the Thermal Expansion Characteristics of Delta, Delta-Prime, and Epsilon Plutonium.** F. H. Ellinger. *Journal of Metals*, v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 206, Oct. 1956, p. 1256-1259.

X-ray diffraction patterns were taken in powder cameras using filtered CuK radiation. Sample was composed of metal filings mixed with a proportion of silver powder and was contained in an evacuated capillary tube. (M26, P11, Pu)

**455-M. Study of Ferrous Ternary Diagrams in Relation to Magnetic Interactions: Fe-Ni-Al System.** Ulrich H. Roesler. *Journal of Metals*, v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 206, Oct. 1956, p. 1285-1289.

Thermodynamic analysis of the gamma loop in iron alloys was applied. The two separate parameters obtained describe influence of alloying elements upon magnetic transformation range and hypothetical martensite temperature. (M24, P16, Fe, Ni, Al)

**456-M. Intermediate Phase in the Uranium-Zirconium System.** A. N. Holden and W. E. Seymour. *Journal of Metals*, v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 206, Oct. 1956, p. 1312-1316.

System studied with particular regard to the existence, stability and mechanism of formation of intermediate phase. Phase diagram. (M24, U, Zr)

**457-M. Gamma Loop Studies in the Iron-Silicon and Iron-Silicon-Titanium Systems.** Gordon G. Bentle and W. P. Fishel. *Journal of Metals*, v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 206, Oct. 1956, p. 1345-1348.

Dilation studies were made on 15 binary and 38 ternary alloys to determine the Ac$_3$ transformation temperature. Points taken from temperature versus expansion curves were used to establish the limit of the gamma iron region. (M24, Si, Fe, Ti)

**458-M. Direct Observations of the Arrangement and Motion of Dislocations in Aluminium.** P. B. Hirsch, R. W. Horne and M. J. Whelan. *Philosophical Magazine*, v. 1, ser. 8, no. 7, July 1956, p. 677-684.

Electron optical experiments on aluminum foils have revealed individual dislocations in the interior of the metal, and their arrangement and movement were observed. (M26, Al)

**459-M.** (English.) **A Summation Method for Crystal Statistics.** David Park. *Physica*, v. 22, no. 10, Oct. 1956, p. 932-940.

Procedure is applied to evaluate the spontaneous magnetization of square and cubical Ising lattices. (M26)

**460-M.** (English.) **Electron Diffraction Study on Thin Alloy Films of Aluminium-Silver System.** Denjiro Watanabe. *Physical Society of Japan, Journal*, v. 11, No. 10, Oct. 1956, p. 1072-1078.

The hexagonal close packed and cubic $\beta'$ phases were examined; also, the processes by which equilibrium was obtained after successive heat treatments. (M22, M24, N9, Ag, Al)

**461-M.** (English.) **Heating and Cooling the Specimen in the Electron Microscope.** Kazuo Ito. *Revue Universelle des Mines*, v. 12, ser. 9, no. 10, Oct. 1956, p. 421-429.

Results obtained using this technique on an aluminum-copper alloy, on the selective oxidation of $\alpha$-brass, and in the crystallization of mercury. (M21, Sg, Al, Cu)

**462-M.** (English.) **The $\beta$-Ray Microscope and Its Uses in Metallography.** D. J. Shapland, N. Feather and A. F. Brown. *Revue Universelle des Mines*, v. 12, ser. 9, no. 10, Oct. 1956, p. 446-453.

A lens system by which charged particles emitted from radioactive bodies can be focused, permitting resolutions of the order of 1$\mu$ to be obtained in autoradiographs of metal surfaces. (M23)

**463-M.** (English.) **Electron Metallography of Ferrous Materials.** J. Nutting. *Revue Universelle des Mines*, v. 12, ser 9, no. 10, Oct. 1956, p. 512-526.

Reviews contributions to ferrous transformation studies. (M21, N general, Fe)

**464-M.** (French.) **The Modern Methods of Electronic Metallography.** R. Castaing. *Revue Universelle des Mines*, v. 12, ser. 9, no. 10, Oct. 1956, p. 454-465.

Recent improvements in the direct examination of a metal by electron transmission. (M21)

**465-M.** (French.) **The Use of the Electron Microscope in the Study of Phase Transformations in the Solid State in Nonferrous Metals and Alloys.** A. Saulnier. *Revue Universelle des Mines*, v. 12, ser. 9, no. 10, Oct. 1956, p. 486-500.

The electron microscope easily permits study of these states, giving much information on the structures of these alloys. (M21, N general)

**466-M.** (French.) **Some Results From Studies With the Electron Microscope of Ni-Cr-Al-Ti Alloys Used in Aeronautical Turbines.** Y. Baillie. *Revue Universelle des Mines*, v. 12, ser. 9, no. 10, Oct. 1956, p. 507-512.

Results obtained during kinetic studies of the fine structure appearing in nickel: chromium: aluminum: titanium alloys by the replica method. (M21, T24, Ni, Cr, Al, Ti)

**467-M.** (French.) **Morphological Study of Rupture Surfaces With the Electron Microscope.** J. Plateau, G. Henry and C. Crussard. *Revue Universelle des Mines*, v. 12, ser. 9, no. 10, Oct. 1956, p. 543-554.

Classical rupture types (ductile, intergranular, cleavage) and fatigue ruptures examined by the carbon replica technique. (M21)

**468-M.** (French.) **Electron Metallography of Pure Iron and Mild Steel.** F. van Wijk. *Revue Universelle des Mines*, v. 12, ser. 9, no. 10, Oct. 1956, p. 555-558.

Samples were examined after electrolytic polishing. There is evidence that the structures observed are related to the dislocation theory. (M21, Fe, ST)

**469-M.** (German.) **Boundaries and Their Constituents in Iron Materials.** Hans-Kurt Görlich. *Revue Universelle des Mines*, v. 12, ser. 9, no. 10, Oct. 1956, p. 465-470.

Nature, properties and importance of boundaries in metallic polycrystals. A method of isolation which conserves the original position of boundary constituents is developed. (M27, Fe)

**470-M.** (German.) **Carbide Isolation, a New Method of Examination in Electron Microscopy.** Hans Goossens. *Revue Universelle des Mines,* v. 12, ser. 9, no. 10, Oct. 1956, p. 471-476.

Method permits isolation of carbides from the matrix, while conserving their relative position. (M21)

**471-M.** (German.) **Structural Modifications in Ferritic and Austenitic Special Steels by Prolonged Stresses at High Temperatures.** A. Schrader. *Revue Universelle des Mines,* v. 12, ser. 9, no. 10, Oct. 1956, p. 537-543.

Electron microscope studies of a series of refractory steels submitted to creep tests. (M21, Q3, AY)

**472-M.** (German.) **Exposure Diagrams for X-Ray Coarse Structure Photography of Titanium.** G. Schuhmacher. *Technische Mitteilungen Krupp,* v. 14, no. 4, Sept. 1956, p. 114.

Diagram is presented and explained. (M22, M26, Ti)

**473-M.** (Russian.) **Investigation of the Five-Component System, Nickel-Chromium - Tungsten - Titanium - Aluminum.** I. I. Kornilov, L. I. Priakhina and O. V. Ozhimkova. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk,* no. 8, Aug. 1956, p. 885-888.

Investigation in the region of nickel solid solution using a spatial system. Study of alloys with variable content of aluminum, titanium and tungsten resulted in formulating alloys with high mechanical properties. (M24. Q general, Ni, Al, Ti, W. Cr)

**474-M.** (Russian.) **Relation Between Mechanical Properties of Solids and Reaction of Atoms in Lattice.** B. M. Rovinskii. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk,* no. 9, Sept. 1956, p. 55-64.

Attempt to determine the relation between mechanical properties of solids and bond strength of atoms in the lattice. (M26, Q general)

**475-M.** (Russian.) **Crystalline Orientation in Electrolytically Precipitated Tin.** S. M. Kochergin and V. N. Nikulin. *Zhurnal Fizicheskoi Khimii,* v. 30, no. 8, Aug. 1956, p. 1727-1728 + 1 plate.

Effect of electrolyte condition on the crystalline orientation of tin in a sulfuric acid bath. Effect of current density. (M26, N12, Sn)

**476-M.** (Russian.) **Calculation of Simple Equilibrium Diagram of Ternary Alloys. I. General Equations and Their Solution in Case of Dissociation Without a Phase Transition.** B. Ia. Pines. *Zhurnal Tekhnicheskoi Fiziki,* v. 26, no. 9, Sept. 1956, p. 2108-2118.

General equations of 2, 3 and 4-phase equilibrium in a ternary system. (M24)

**477-M. Constitution of Nickel-Rich Quaternary Alloys of the Ni-Cr-Ti-Al System.** A. Taylor. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Sec. 2, Oct. 1956, p. 1356-1362.

Quaternary system was studied up to 1150° C. for compositions greater than 50 at. % nickel. The region contains six single-phase areas. (M24, Ni, Ti, Cr, Al)

**478-M.** (French.) **Study, by Electron Diffraction, of the Crystallization and Oxidation of Thin Germanium Films.** J. J. Trillat, L. Tertian and A. Fourdeux. *Vide,* v. 11, no. 64, July-Aug. 1956, p. 190-193.

A study of the transformations taking place in very thin germanium films obtained by thermal evaporation from the amorphous state at low temperature to well crystallized germanium dioxide at 600° C. (M26, Ge)

**479-M.** (Russian.) **Radiographic Investigation of Intercrystalline Nonhomogeneity of Sulphur and Phosphorus in Welded Joints.** B. A. Movchan and L. A. Pozniak. *Avtomaticheskaia Svarka,* v. 9, no. 4, July-Aug. 1956, p. 76-87.

Effect of cooling and heating on the crystalline nonhomogeneous distribution of sulphur in the welding joint metal. (M26, K9, ST)

**480-M.** (Russian.) **The De Haas-Van Alphen Effect for the Firmly Bound Electrons of the Lattice.** G. E. Zil'berman. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 18-21.

Oscillations of physical quantities with a changing magnetic field are treated on the basis of the model of firmly bound electrons with varying degrees of occupation of the energy zone. A criterion for the occupation of the zone is derived. (M25, P16)

**481-M.** (Russian.) **Classification of Ternary Metallic Phases.** B. K. Vul'f. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 97-112.

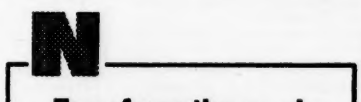
A system of classifying ternary metallic phases according to the area and location of the homogeneity zones in ternary equilibrium diagrams. Comparison with other classification systems. (M24)

**482-M.** (Book—German.) **Constitution of Ternary Metallic Systems.** W. Guertler. Not paged. 1956. Gemeinnütziges Archiv für Metallkunde, Berlin, Germany.

Graphs of 10 ternary iron combinations and their austenitic relations. (M24, Fe, Mn, Co, Ni, Cu)

**483-M.** (Book—German.) **Handbook of Special Steel Metallography.** Eduard Houdremont. 3rd Rev. Ed. v. II. 1538 p. 1956. Springer-Verlag, Berlin, Germany.

Structure and properties of steels containing tungsten, molybdenum, vanadium, cobalt, silicon, aluminum, copper, oxygen, nitrogen, hydrogen, phosphorus, sulfur, titanium, columbium, tantalum, boron and rare metals. (M general, Q general, AY)



## Transformations and Resulting Structures

**490-N. Solubility Determination, Diffusion and Mechanical Effects of Hydrogen in Uranium.** W. D. Davis. *Knolls Atomic Power Laboratory (U. S. Atomic Energy Commission),* KAPL-1548, Aug. 1956, 67 p.

Analytical method for determining solubility in the alpha phase for biscuit uranium. (N1, N12, U)

**491-N. The de Haas-van Alphen Effect in Alloys.** V. Heine. *Physical Society, Proceedings,* v. 69, no. 439A, July 1956, p. 505-512.

Theory of primary solid solutions applied to dilute alloys. Experimental results were in agreement with theory, except where there is a bound state around the solute atoms. (N12)

**492-N.** (English.) **The Advance of Mono-Molecular Steps on the Surface of a Growing Kossel Crystal as a Random Walk Problem.** R. Gevers. *Physica,* v. 22, no. 9, Sept. 1956, p. 832-842.

If supersaturation and jump probabilities, which depend strongly on temperature, are given, an expression for lateral growth velocity of step can be calculated. (N12)

**493-N.** (French.) **A Few Considerations on the Determination of the Points of Transformation of Steels Through the Differential Dilatometric Method.** J. Papier. *Centre de Documentation Siderurgique, Circulaire d'Informations Techniques,* v. 13, no. 9, 1956, p. 1831-1835.

Comparison of dilatometric diagrams applied to self-hardening, manganese-silicon, and chromium steels. Analysis of the method as regards its accuracy and advantages. (N8, AY)

**494-N.** (German.) **Pearlite and Martensite Formation in Hard Manganese Steel.** Klaus J. Janssen and Werner Jellinghaus. *Archiv für das Eisenhüttenwesen,* v. 27, no. 9, Sept. 1956, p. 573-578.

Investigation of structure and saturation measurement on 400 to 750° C. isothermally transformed samples of manganese steel with 1.29% carbon and 13% manganese. Temperature-magnetization curves for determination of martensite point and the carbide-Curie point. (N8, AY)

**495-N.** (German.) **Electron-Emissions During Smelting and Crystallization of Metals.** Jürgen Lohff. *Zeitschrift für Metallkunde,* v. 47, no. 9, Sept. 1956, p. 644-646.

The electron emission of Woods metal, bismuth, tin and lead during fusion and solidification in vacuum was investigated. (N12, Bi, Pb, Sn)

**496-N.** (Italian.) **The Zone-Melting Process in the Study of Systems With More Than Two Components.** F. Mazzoleni. *Metallurgia Italiana,* v. 48, no. 9, Sept. 1956, p. 401-405.

Possibilities of application of zone-melting process to the experimental study of metal alloys with two or more components, particularly to direct determination of possible eutectic composition. (N12, C5)

**497-N.** (Russian.) **Diagram of Chromium Recrystallization.** E. M. Savitskii, V. F. Terekhova and A. V. Kholopov. *Doklady Akademii Nauk SSSR,* v. 109, no. 4, Aug. 1, 1956, p. 794-795 + 1 plate.

Construction of recrystallization diagram of electrolytic chromium permits determination of change in crystalline structure in respect to annealing temperature and degree of cold deformation. (N5, Cr)

**498-N.** (Russian.) **X-Ray and Electron-Microscopic Investigation of the Aging of Al-Zn Alloy.** N. N. Buinov and L. I. Podrezov. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia,* v. 20, no. 6, June 1956, p. 611-613 + 1 plate.

Role of zinc in concentrating along zones determines aging process. Role of stresses caused by "hydrostatic" pressure. Restructuring of crystal lattice. (N7, Al, Zn)

**499-N.** (Russian.) **Change in Fine Crystal Structure of Austenitic Manganese Steel During Plastic Deformation.** O. V. Bogorodskii and Ia. S. Umanskii. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia,* v. 20, no. 6, June 1956, p. 614-620.

Two methods of calculating mosaic-block structure and micro-deformations. Strain-hardening factor during cold deformation can be calculated. (N8, Q24, AY)

500-N. (Russian.) **Investigation of the Eutectoid Transformation of an Alloy of Copper and Tin.** M. I. Zakharova and I. B. Mogarycheva. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia,* v. 20, no. 6, June 1956, p. 621-623 + 1 plate.

Eutectoid transformation of the beta phase in alloys of copper with 27% tin at temperatures of 150 to 350° C. takes place successively in different zones of the single crystal. (N9, Cu, Sn)

501-N. (Russian.) **Structural Changes in Pure Metals During Stress Relaxation.** B. M. Rovinskii and V. G. Liutsai. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia,* 20, no. 6, June 1956, p. 636-638 + 1 plate.

During relaxation in aluminum and copper irreversible structural changes develop in the crystallites similar to those during small plastic deformation. (N6, Q24, Al, Cu)

502-N. (Russian.) **Change in Substructure of Aluminum in Small Plastic Deformation and in Creep.** B. M. Rovinskii and L. M. Rybakova. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia,* v. 20, no. 6, June 1956, p. 646-649 + 1 plate.

Interference-spot X-ray pictures show that structural changes within crystallites during creep are qualitatively similar to those during simple tension. Application of a load directly increases the completeness of crystallites. (N6, Q3, Q27, Al)

503-N. (Russian.) **X-Ray Study of the Recrystallization of Some High-Melting Compounds.** S. S. Gorelik and Ia. S. Umanskii. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia,* v. 20, no. 6, June 1956, p. 650-652.

Relation of start of recrystallization to annealing temperatures for tungsten carbide and nickel-aluminum. Relaxation begins before recrystallization. (N5, Ni, Al, W)

504-N. (Russian.) **Peculiarities of the Recrystallization of Some Two-Phase Aging Alloys.** S. S. Gorelik. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia,* v. 20, no. 6, June 1956, p. 653-658 + 1 plate.

Relation between degree of deformation and recrystallization starting temperature. Effect of aging prior to deformation.
(N5, N7, Ni, Cu, Cr, Be, Al, Ti)

505-N. (Russian.) **X-Ray Study of Secondary Structure of Crystallites of Recrystallized Metals.** V. N. Shcherbakov. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia,* v. 20, no. 6, June 1956, p 714-720.

Mosaic disorder of primary polycrystalline structure of crystallites. Effect of type and per cent of impurities and course of heat treatment on mosaic disorder.
(N5, Al, Cu)

506-N. **The Tempering of Plain Carbon Steels.** E. D. Hyam and J. Nutting. *Iron and Steel Institute, Journal,* v. 184, Oct. 1956, p. 148-165.

Progress of tempering was followed by taking hardness measurements, from which it was possible to calculate activation energy of softening process. Softening is controlled by a mechanism involving self-diffusant thickness. (N15, M26, Zn)

507-N. **Growth Mechanisms of Near-Perfect Crystals.** G. W. Sears and R. V. Coleman. *Journal of Chemical Physics,* v. 25, Oct. 1956, p. 635-637.

Direct evidence that whisker growth by vapor deposition occurs at the tip rather than the base. Platelets are shown to grow at constant thickness. (N15, M26, Zn)

508-N. **Growth of Mercury Platelets From the Vapor.** Gerald W. Sears. *Journal of Chemical Physics,* v. 25, Oct. 1956, p. 637-642.

Mechanism for the vapor deposition. Growth behavior is accounted for on the basis of a single screw dislocation in a [110] crystallographic direction. (N15, M26, Hg)

509-N. **Distribution Coefficient of Boron in Germanium.** Henry E. Bridgers and E. D. Kolb. *Journal of Chemical Physics,* v. 25, Oct. 1956, p. 648-650.

Measurements made as a function of crystal growth rate. Behavior agrees with that predicted by the theory of Burton for a solute whose equilibrium distribution coefficient is greater than unity. (N12, Ge)

510-N. **Solubility of Lithium in Doped and Undoped Silicon, Evidence for Compound Formation.** H. Reiss, C. S. Fuller and A. J. Pietruszkiewicz. *Journal of Chemical Physics,* v. 25, Oct. 1956, p. 650-655.

At both low and high temperatures the solubility in the doped crystal markedly exceeds that in the undoped one. It just about equals the boron concentration in these ranges. (N12, Li)

511-N. **Theory of the Ionization of Hydrogen and Lithium in Silicon and Germanium.** Howard Reiss. *Journal of Chemical Physics,* v. 25, Oct. 1956, p. 681-686.

Effective mass-quantum mechanical investigation of the ionizability of interstitial hydrogen and lithium. Concludes that hydrogen should not ionize while lithium should.
(N12, M25, Li, Si, Ge)

512-N. **Sympathetic Nucleation of Ferrite.** H. I. Aaronson and C. Wells. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1216-1223.

Configurations of ferrite crystals found in a plain carbon steel appear to have resulted from the nucleation of new ferrite crystals at the interphase boundaries of previously formed crystals, despite the high carbon concentrations. (N2, CN)

513-N. **Temperature Dependence of Recovery Phenomena in a Cold Rolled Aluminum Single Crystal.** A. H. Lutts and Paul A. Beck. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions, v. 206, Oct. 1956, p.* 1226-1228.

Study of line sharpening and of the initial softening with high-purity aluminum. Isothermal line sharpening data and softening curves obtained for several temperatures.
(N4, Al)

514-N. **Recovery of Cold Worked High Purity Al-Mg Alloys.** E. C. W. Perryman. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1247-1252.

Recovery of X-ray line broadening, hardness and electrical resistivity was investigated. Results suggest that magnesium atoms freeze in the excess vacancies and that this affects the climb of dislocations during the recovery process.
(N4, Al, Mg)

515-N. **Neutron Diffraction Study of Annealing Textures in Drawn Body-Centered Cubic Metals.** R. A. Swalin and A. H. Geisler. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1259-1263.

Cold drawn molybdenum, iron and an iron-base alloy containing 14% aluminum investigated as a function of annealing temperature by using diffraction techniques. Upon recrystallization, the [110] deformation texture was retained in all cases.
(N5, Q24, Al, Fe, Mo)

516-N. **Study of the Fe-Si Order-Disorder Transformation.** Frank W. Glaser and W. Ivanick. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1290-1295.

Silicon content in disordered samples ranged from 8 to 28 at. %. Critical temperature for disorder was highest for the stoichiometric composition of $Fe_3Si$. (N10, P, Si, Fe)

517-N. **Recrystallization and Grain Growth in Iodide Zirconium.** R. M. Treco. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1304-1311.

Investigation of swaged crystal bar zirconium. Plastic deformation and growth processes affecting the microstructure were studied.
(N5, N3, Q24, Zr)

518-N. **Self-Diffusion of Iron in Austenite.** H. W. Mead and C. E. Birchenall. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1336-1339.

Studied for 0 to 1.4 wt. % C. from 1000 to 1300° C. A large increase in diffusivity and decrease in activation energy with increasing carbon content were observed. (N1, Fe)

519-N. **Interaction of Dislocations and Long-Range Order.** N. Brown and M. Herman. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1353-1354.

Metal under consideration is the *A-B*, body-centered type, such as $\beta$ brass. The slip system is taken to be [111], (110). (N10, Cu)

520-N. (Czech.) **Some Remarks on the Crystallization of Metals.** *Slévarenstvi,* v. 4, no, 9, Sept. 1956, p. 263-267.

Explains the influence of inclusions upon the structure of alloys and mentions some methods of refining crystalline structure. (N12)

521-N. (French.) **Contribution to the Study of the Alterations in Steel Structures Caused by Fatigue.** A. Kochanovska, J. Cermak, and F. Holy. *Revue de Métallurgie,* v. 53, no. 9, Sept. 1956, p. 701-702.

Alterations studied by X-rays on low alloy steels. (N8, Q7, AY)

522-N. (Russian) **Structural Nonhomogeneity of Austenite Micrograin at Higher Temperatures.** V. I. Prosvirin. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk,* no. 9, Sept. 1956, p. 117-120.

Microhardness of austenite after quenching at 1250° C. and additional heating for 6 hr. Increase of nonhomogeneity with high temperature.
(N8, Q29, ST)

523-N. (Russian.) **Physical Methods of Studying Low-Rate Transformations in High-Alloy Steel.** Ia. S. Gintsburg, Iu. M. Margolin and A. F. Sachavskii. *Zavodskaia Laboratoriia,* v. 22, no. 9, Sept. 1956, p. 1046-1052.

Advantages of the magnetic, X-ray crystal and chemical phase analyses for the investigation of fine transformations in nonmagnetic steels. (N8, M22, M23, AY)

524-N. (Russian.) **Evaluating the Degree of Dendritic Liquation of Carbon**

**in Steel by the Microhardness Method.** I. N. Golikov and E. D. Mokhir. *Zavodskaia Laboratoriia,* v. 22, no. 9, Sept. 1956, p. 1052-1056.

Method of quantitative evaluation of the dendritic nonuniformity of carbon distribution in steels with up to 0.45% carbon by microhardness measurements. (N12, Q29, CN)

**525-N.** (Spanish.) **A Contribution to the Study of the Influence of the Physicochemical State of Fe-C Alloys on Spectral Emission. Spectrographic Determination of the Cementite Coalescence in Steels.** E. Asensi Alvarez-Arenas and G. del Olmo Vega. Paper from "XXVIII Congreso Internacional de Quimica Industrial". v. I. Saez, p. 521-526.

Coalescence is studied by a spectral method, based on the special value acquired by Δs according to the microstructural constituents and in relation to previous thermal treatment. (N8, ST)

**526-N. Effect of Noncollimated Radiation on Surface Activity Methods for the Determination of Diffusion Coefficients in Solids.** R. H. Condit and C. E. Birchenall. *Journal of Metals, v. 8; American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, sec. 2, Oct. 1956, p. 1341-1344.

Contributions or radiations arriving at a diffusion specimen surface, including angles other than 90°, were evaluated for a number of counting geometries. MnK $\alpha$-radiation from iron-55 was used to obtain a monochromatic source of X-rays. (N1)

**527-N. Structural Changes During the Aging in an Al-Mg-Zn Alloy.** L. F. Mondolfo, N. A. Gjostein and D. W. Levinson. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, sec. 2, Oct. 1956, p. 1378-1385.

When aging at low temperatures (up to 200° C.) the precipitate which formed was $MgZn_2$; above 300° C., $(AlZn)_{49}Mg_{32}$; at intermediate temperatures both phases formed. (N7, M24, Al, Mg, Zn)

**528-N. The Martensitic Transformation in the Iron-Nickel System.** Larry Kaufman and Morris Cohen. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, sec. 2, Oct. 1956, p. 1393-1401.

The martensite-start temperature on cooling and the austenite-start temperature on heating in the iron-nickel system determined between 9.5 and 33.2 at. % nickel. (N8, Fe, Ni)

**529-N. Matrix Phase in Lower Bainite and Tempered Martensite.** F. E. Werner, B. L. Averbach and Morris Cohen. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, sec. 1, Oct. 1956, p. 1484.

Bainite formed near the $M_s$ temperature bears a striking resemblance to martensite tempered at the same temperature as shown by the electron microscope. (N8)

**530-N.** (English.) **A Quantitative Study of the Formation of Austenite and the Solution of Cementite at Different Austenitizing Temperatures for a 1.27% Carbon Steel.** Göran Molinder. *Acta Metallurgica,* v. 4, no. 6, Nov. 1956, p. 565-571.

The course of transformation after rapid heating to temperatures above $AC_1$ investigated to quantitatively. (N8, CN)

**531-N.** (English.) **Precipitate Kinetics and Structure in a Cu-2.4% Fe Alloy.** J. M. Denney. *Acta Metallurgica,* v. 4, no. 6, Nov. 1956, p. 586-592.

Kinetics of the isothermal precipitation of Fe from a supersaturated solid solution of 2.4% Fe copper alloy in the temperature range 550 C. to 800° C. were obtained from measurements of the saturation magnetization of the specimens. (N7, Cu, Fe)

**532-N.** (English.) **The Formation of Low-Energy Interfaces During Grain Growth in Alpha and Alpha-Beta Brasses.** Hsun Hu and Cyril Stanley Smith. *Acta Metallurgica,* v. 4, no. 6, Nov. 1956, p. 638-646.

Measurements were made of the relative areas of types of interface observable in the microstructure. Interfaces across which two phases are related in orientation are common, and their fraction increases as grain size of duplex mixture increases. (N3, Cu)

**533-N.** (Russian.) **On the Lowering of Temperature at the Beginning of Martensite Transformation Due to Partial Decomposition of Austenite in the Bainite Range.** V. I. Arkharov, V. P. Skliuev and V. O. Esin. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 62-65.

Reviews problem and offers a new view of the connection between the temperature decrease and the decomposition of austenite. (N8, ST)

**534-N.** (Russian.) **The Kinetics of Growth of the Diffusion Layer in Boron Treatment of Steel.** V. D. Taran and L. P. Skugorova. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 66-69.

Studies diffusion of boron into low-alloy and carbon structural steels. Boron penetration follows the parabolic law of growth of the diffusion layer. (N1, AY)

**535-N.** (Russian.) **On the Diffusion Mobility of Atoms During the Fusion and Recrystallization of Metals.** P. L. Gruzin and A. D. Tiutiunnik. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 70-75.

Fusion and recrystallization have different threshold levels of diffusion mobility; the level in fusion is $10^{14}$ times higher than that in recrystallization. (N1, N5)

**536-N.** (Russian.) **On the Influence of High Pressure on Recrystallization in Copper.** V. I. Arkharov and D. K. Bulychev. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 76-78 + plate.

Suggests that relaxation processes in deformed crystals are at first retarded but later on attenuate at a slower rate than in the absence of pressure. (N5, Cu)

**537-N.** (Russian.) **On the Theory of the Polymorphism of Iron.** V. N. Svechnikov and A. G. Lesnik. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 87-96.

Phase equilibrium curves of solid solutions of iron agree well with curves of the second order; those calculated for the iron-chromium system are in good agreement with experimental data. (N6, Fe, Cr)

**538-N.** (Russian.) **On the Pearlite Transformation in Alloy Steels.** R. I. Entin. *Metallovedenie i Obrabotka Metallov,* no. 9, Sept. 1956, p. 3-9.

Crystallization parameters and carbide formation in the isothermal decomposition of austenite and the kinetics of the polymorphic transformation in iron. (To be continued.) (N8, AY)

**539-N.** (Russian.) **Migration of Hydrogen in Hard Steel Under the Influence of an Electric Field.** V. I. Iavoiskii and D. F. Chernega. *Stal',* v. 16, no. 9, Sept. 1956, p. 790-793.

Experimental data on high and medium-carbon and manganese steels show a gradual migration of hydrogen toward the cathode under the influence of a direct current. The amount transferred is insignificant and cannot serve for degasification of carbon and low or medium alloyed steels. (N12, ST)

**540-N.** (Russian.) **Effect of Ultrasonic Oscillations on the Processes in Metal Alloying.** N. T. Gudtsov and M. N. Gavze. *Zhurnal Neorganicheskoi Khimii,* v. 1, no. 7, July 1956, p. 1533-1538 + 1 plate.

Acceleration of processes of dispersion hardening. Experimental data. (N7)

# P
# Physical Properties and Test Methods

**474-P. Conversion From Weight Per Cent to Atomic Per Cent in Binary Alloys.** F. Forscher and W. Deboskey. *Metal Progress,* v. 70, Oct. 1956, p. 96B.

Only calculation required is computation of ratio between atomic weights of the elements. Chart may also be used if the atomic per centages are known and weight percentages are wanted. (P10)

**475-P. Superconducting Transition in Aluminum.** J. F. Cochran, D. E. Mapother and R. E. Mould. *Physical Review,* v. 103, ser. 2, Sept. 15, 1956, p. 1657-1669.

Behavior of an accurately ellipsoidal single crystal of pure aluminum studied by using high-precision ballistic induction method which is suited for studying the reversibility of transition. (P15, N11, Al)

**476-P. Electron Characteristic Energy Losses in Metals and Compounds.** Lewis B. Leder. *Physical Review,* v. 103, ser. 2, Sept. 15, 1956, p. 1721-1726.

Losses were measured with an improved technique designed to give more reliable intensity relationships. Compound spectra show a decided similarity to the spectra of parent metal. (P15, Al, Sb, Ca, Pb, Na, Te)

**477-P.** (English.) **The Effect of the Induced Uniaxial Anisotropy on the Domain Wall Displacements and Magnetic Behavior of Ferromagnetic Cubic Solid Solutions.** Satoshi Taniguchi. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 8, no. 3, June 1956, p. 173-192.

Uni-axial anisotropy is induced along magnetization vectors oriented in compliance with the domain distribution present during the heat treatment. (P16)

**478-P.** (English.) **Electrical Resistivity and Hall Effect of Noble Metals at Very Low Temperatures.** Tadao Fukuroi and Toshio Ikeda. *Science Reports of the Research Institutes, Tohoku University,* ser. A, v. 8, no. 3, June 1956, p. 205-212.

Studies of gold, silver and copper. Gold showed the minimum in the resistance-temperature curve at about 6° K., below which the Hall effect was found to be temperature-dependent. (P15, Au, Ag, Cu)

**479-P.** (English.) **Specific Heat of Tellurium and Selenium at Very Low Temperatures.** Tadao Fukuroi and Yoshio Muto. *Science Reports of the Re-*

*search Institutes, Tohoku University,* ser. A, v. 8, no. 3, June 1956, p. 213-222.

Measurements in the range of liquid helium temperatures with a calorimeter of Nernst-Eucken's type. Discussions of the specific heat of these metals at low temperatures from the viewpoint of the anisotropy of the chain-like crystal lattice. (P12, M26, Te, Se)

**480-P.** (French.) **Austenitic-Ferritic Stainless Steels.** Joseph Hochmann. Paper from "XXVIII Congreso Internacional de Quimica Industrial". v. I. Saez, p. 558-562.

Magnetism of steels in relation to resistance to intergranular corrosion, structural hardening and resistance to general corrosion. (P16, R2, SS)

**481-P.** (German.) **The Structure Enthalpy of the System Copper-Selenium.** G. Gattow and A. Schneider. *Zeitschrift für Anorganische und Allgemeine Chemie,* v. 286, no. 5-6, Sept. 1956, p. 296-306.

Determination of structural enthalpy of alpha and beta $Cu_2Se$, $Cu_3Se_2$, CuSe and $CuSe_2$. (P12, Cu, Se)

**482-P.** (Russian.) **X-Ray Investigation of Compounds in Systems Bi-Rh and Bi-Pd in Connection With a Study of Superconductivity.** N. N. Zhuravlev and G. S. Zhdanov. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia,* v. 20, no. 6, June 1956, p. 708-713.

Relation between crystal structure and superconductivity and between polymorphic transformations of binary compounds and change of transition temperature for going into superconductive state. (P15, M26, Bi, Pd, Rh)

**483-P.** (Spanish.) **A Contribution to the Spectral Study of the Metallic State of RR-59 Light Alloy.** A. Camunas and Carmen Lago. Paper from "XXVIII Congreso Internacional de Quimica Industrial". v. I. Saez, p. 581-586.

Spectral techniques were used to study the spark effect in order to obtain the constant values of $\Delta S$. Values were obtained for each alloying element. These values corresponded to various states of alloy produced by specific thermal treatment. The possibility of studving spectrographically the physicochemical aging of the RR-59 alloy is discussed. (P12, N7, Si, Ni, Mg, Mn, Cu, Fe)

**484-P.** (Swedish.) **Material Problems Involved in Radiochemical Methods.** Roland Kiessling. *IVA Tidskrift för Teknisk-Vetenskaplig Forskning,* v. 27, no. 5, 1956, p. 196-202.

Effects of irradiation on strength, thermal and electrical conductivity, external dimensions of fissionable and nonfissionable metals. (P general)

**485-P. The Dynamic Magnetostriction of Nickel-Cobalt Alloys.** C. A. Clark. *British Journal of Applied Physics,* v. 7, Oct. 1956, p. 355-360.

Measurements, at various polarizing fields, of the electromechanical coupling coefficient, reversible permeability and Young's modulus. Criteria governing the choice of magnetic materials for ultrasonic transducers. (P16, Ni, Co)

**486-P. Plasma Oscillations and the Electron Theory of Metals.** S. Raimes. *Research,* v. 9, Oct. 1956, p. 374-380.

Electronic interactions affecting properties of metals. Calculations based upon the application of plasma theory to an electron gas. Analogy suggests the existence of oscillations in metals. (P15)

**487-P.** (English.) **On the Magnetic Properties of the System MnSb-CrSb.** Tokutaro Hirone, Seijiro Maeda, Ichiro Tsubokawa and Noboru Tsuya. *Physical Society of Japan, Journal,* v. 11, no. 10, Oct. 1956, p. 1083-1087.

The change of magnetic properties due to the replacement of manganese by chromium in manganese antimonide was investigated. (P16, Cr, Mn, Sb)

**488-P.** (French.) **Grain Structure and Electrical Conductivity of Aluminum and Its Alloys.** E. Nachtigall. *Revue de Métallurgie,* v. 53, no. 9, Sept. 1956, p. 660-664.

Conductivity is governed by the chemical composition, grain structure and the degree of cold working. (P15, Al)

**489-P.** (Russian.) **Determination of Iron in Bimetallic Copper-Steel Bars and Rods by the Thermo-Electric Method.** P. D. Korzh. *Zavodskaia Laboratoriia,* v. 22, no. 9, Sept. 1956, p. 1076-1078.

Thermo-electric determination of iron contamination in the copper in bimetallic copper-steel bars. A dependence of the thermo-electromotive force on temperature and concentration of iron in the alloy is established. (P15, Fe, Cu)

**490-P.** (Russian.) **Effect of Heat Conductivity on Electrical Erosion of Metals.** A. S. Zingerman. *Zhurnal Tekhnicheskoi Fiziki,* v. 26, no. 9, Sept. 1956, p. 2008-2020.

Heat distribution in electrodes and surface of heat source. Experimental and theoretical data. (P11)

**491-P.** (Russian.) **Heat Conductivity of Technical Materials at Low Temperatures.** N. V. Zavaritskii and A. G. Zel'dovich. *Zhurnal Tekhnicheskoi Fiziki,* v. 26, no. 9, Sept. 1956, p. 2032-2036.

Measurements on copper, bronze, stainless steel, copper-nickel-zinc alloy, and others. (P11)

**492-P. X-Ray Diffraction Determination of the Coefficients of Expansion of Alpha Uranium.** J. R. Bridge, C. M. Schwartz and D. A. Vaughan. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, sec. 2, Oct. 1956, p. 1282-1285.

The unit cell dimensions of orthorhombic uranium were determined over the temperature range −253 to 640° C. Above room temperature, these data were found to fit several equations. Mean coefficients were computed and compared with dilatometer data. (P11, U)

**493-P. Difference Between Normal and Superconducting States of a Metal.** G. V. Chester. *Physical Review,* v. 103, ser. 2, Sept. 15, 1956, p. 1693-1699.

Properties of differences are established and a numerical calculation is carried out. All differences are of same order of magnitude, but all vanish at transition temperature. Results are discussed from physical point of view. (P15)

**494-P.** (English.) **The Resistivity-Temperature-Concentration Relationships in $\beta$-Phase Titanium-Hydrogen Alloys.** S. L. Ames and A. D. McQuillan. *Acta Metallurgica,* v. 4, no. 6, Nov. 1956, p. 602-610.

Results indicate that at 480° C., below the transformation temperature, the resistivity of beta-titanium would have fallen only 2% below the value of the resistivity immediately above the transformation temperature. (P15, P12, M24, Ti)

**495-P.** (English.) **Subgrain and Electrical Resistivity Studies of Molybdenum Single Crystals.** K. T. Aust and R. Maddin. *Acta Metallurgica,* v. 4, no. 6, Nov. 1956, p. 632-637.

Resistivity during room-temperature bending increases slightly initially and is followed by rapid coincident with crossing slip bands. Etch-pit density measurements are proportional to reciprocal of bend radius. (P15, Mo)

**496-P.** (German.) **Calorimetry and Thermodynamics of Lead-Antimony Alloys.** Willy Oelsen, Friedrich Johannsen and Anton Podgornik. *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 9, no. 10, 1956, p. 459-469.

Measurements with small calorimeter, thermodynamic evaluation, phase diagram, activity of lead-antimony in liquid mixtures, mixing entropy. (P12, M24, Pb, Sb)

**497-P.** (Russian.) **A Study of the Temperature Dependence of Heat Conductivity, Electrical Conductivity, and Heat Capacity of Bi, Pb, and Alloys of the Bi-Pb System.** V. E. Mikriukov and N. A. Tiapunina. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 31-41.

The semiconductive properties found in bismuth-lead alloys are explained by the effect of the solid solution of lead in bismuth, which reduces both electrical conductivity and heat capacity. (P11, P15, N12, Bi, Pb)

**498-P.** (Russian.) **A Study of Powder Patterns on Transformer Steel Crystals.** V. D. Dylgerov. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 42-46 + 1 plate.

A study of transformer steel containing 3.42% silicon and displaying texture. (P16, AY)

**499-P.** (Russian.) **On Magnetic Anisotropy Constants in Iron-Silicon Alloys.** V. V. Druzhinin. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 47-54.

Determined constants from the moment of rotation of a single-crystal disk in a strong magnetic field. (P16, Fe, Si)

**500-P.** (Russian.) **The Influence of the Ordering Process on the Temperature Dependence of the Magnetic Properties of a Fe-Ni-Mo Alloy.** M. V. Dekhtiar. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 55-61.

A study of the temperature dependence of the saturation magnetization of molybdenum permalloys. The abnormalities of the dependence at certain temperatures are considered indicative of an ordering process within the crystal lattice. (P16, AY)

**501-P.** (Russian.) **Determination of Melting Temperature of Certain Metals Under Superpressure.** V. P. Butuzov and M. G. Gonikberg. *Zhurnal Neorganicheskoi Khimii,* v. 1, no. 7, July 1956, p. 1543-1547.

Measuring melting temperatures of bismuth, tin and lead, under pressures up to 33,000 kg. per sq. cm. (P12, Bi, Sn, Pb)

**502-P.** (Russian.) **Thermodynamics of Cast Iron Desulphurization.** A. M. Samarin and I. S. Kulikov. *Zhurnal Neorganicheskoi Khimii,* v. 1, no. 7, July 1956, p. 1566-1577.

Distribution and solubility of sulphides in iron. Thermodynamics of desulphurization from experimental and theoretical data. (P12, Fe)

# Q

## Mechanical Properties and Test Methods; Deformation

**947-Q. Turbine Disks for Jet Propulsion Units. III. Blade Root Fixing of Turbine Disks for Jet Engine Units.** A. E. Johnson. *Aircraft Engineering*, v. 28, Oct. 1956, p. 348-356.

Results and implications of creep tests on blade root fastenings using composite specimens of disk and blade materials, reproducing the form and dimensions of blade root fastenings used in practice. (Q3, K13)

**948-Q. Validity of Time-Compensated Temperature Parameters for Correlating Creep and Creep-Rupture Data.** F. Garofalo, G. V. Smith and B. W. Royle. *ASME, Transactions*, v. 78, Oct. 1956, p. 1423-1434.

A so-called master "curve" is discussed in terms of experimentally determined relationships. The parameters are not single-valued functions of the initial stress over wide ranges in stress. (Q3, ST)

**949-Q. Mechanical Properties at Elevated Temperatures of Ductile Cast Iron.** F. B. Foley. *ASME, Transactions*, v. 78, Oct. 1956, p. 1435-1438.

Demonstrates the application of the Larson-Miller method. Properties of ferritic ductile cast iron for 100° intervals from 700 to 1200° F. are summarized. (Q general, CI)

**950-Q. Effect of Range of Stress in Combined Bending and Torsion Fatigue Tests of 25S-T6 Aluminum Alloy.** W. N. Findley, W. I. Mitchell and D. D. Strohbeck. *ASME, Transactions*, v. 78, Oct. 1956, p. 1481-1487.

Effect of stress relaxation at high mean stresses was investigated. Applicability of several theories of failure are compared with test data. Influence of anisotropy, mechanism of crack formation, mean stress, and maximum stress. (Q5, Q1, Q7, Al)

**951-Q. The Influence of Shank Area on the Tensile Impact Strength of Bolts.** John Love, Jr., and O. A. Pringle. *ASME, Transactions*, v. 78, Oct. 1956, p. 1489-1496.

Effect of reduction of shank cross-sectional area of steel bolts investigated experimentally. (Q6, Q27, T7, ST)

**952-Q. Report of the Investigation of the Turbine Wheel Fracture at Tanners Creek.** A. W. Rankin and B. R. Seguin. *ASME, Transactions*, v. 78, Oct. 1956, p. 1527-1546.

Major parts of the investigation to determine cause of this fracture, together with the general conclusions. (Q26)

**953-Q. Investigation of Large Steam-Turbine Spindle Failure.** H. D. Emmert. *ASME, Transactions*, v. 78, Oct. 1956, p. 1547-1565.

Investigation of the design, metallurgy and manufacture of the spindle and of the operational history of the Ridgeland turbine showed that initiating cause of accident was flakes or thermal cracks developed in the shaft during heat treatment. (Q26, J general)

**954-Q. Report of the Investigation of Two Generator Rotor Fractures.** C. Schabtach, E. L. Fogleman, A. W. Rankin and D. H. Winne. *ASME, Transactions*, v. 78, Oct. 1956, p. 1567-1584.

Various phases of the investigation, which included a thorough study of features of design and manufacture and the characteristics of the rotor materials, together with a presentation of the results. (Q26)

**955-Q. The Strength of Manholes in Welded Storage Tanks.** P. H. R. Lane and A. A. Wells. *British Welding Journal*, v. 3, Sept. 1956, p. 414-425.

Tests carried out both on full-size manhole openings and on quarter-scale models. (Q23, K1)

**956-Q. Effect of Impurities on the Hardness of Titanium.** T. D. McKinley. *Electrochemical Society, Journal*, v. 103, Oct. 1956, p. 561-567.

Data presented allow the estimation of oxygen in unalloyed titanium from a hardness measurement and a few conventional chemical analyses. (Q29, Sn, Cu, Ni, Ti, Co)

**957-Q. The Value of the Notch Tensile Test.** J. F. Baker and C. F. Tipper. *Institution of Mechanical Engineers, Proceedings*, v. 170, no. 1, 1956, p. 65-75 + 2 plates; disc., p. 76-93.

Investigations indicate that test can reliably predict service performance. Test-piece is easily prepared, can be tested in any tensile testing machine and gives all the information necessary for assessing notch ductility. (Q27)

**958-Q. What Do We Know About Hydrogen in Steel? II.** C. R. Simcoe. *Iron Age*, v. 178, Oct. 11, 1956, p. 102-105.

The influence of hydrogen content, testing temperature and strength level studied in a 3% chromium, 0.44% molybdenum and 0.25% carbon steel. Embrittlement increased with hydrogen content over the range of 1 to 8 ppm. at all testing temperatures. (Q general, J1, Mo, Cr, CN)

**959-Q. Hypo-Elasticity and Plasticity. II.** A. E. Green. *Journal of Rational Mechanics and Analysis*, v. 5, Sept. 1956, p. 725-734.

Derived equations suitable for plastic flow of compressible work-hardening body. Plastic flow of compressible bodies with zero work-hardening discussed. (Q24)

**960-Q. What You Should Know About Hydrogen in Titanium.** D. N. Williams and R. I. Jaffee. *Materials & Methods*, v. 44, Oct. 1956, p. 96-97.

In certain alloys as little as 200 ppm. of hydrogen induces strain-rate sensitivity, causes lower notch toughness and increases thermal instability. (Q23, Ti)

**961-Q. High Strength Nickel-Base Alloy for High-Temperature Service.** *Materials & Methods*, v. 44, Oct. 1956, p. 147-148.

Tensile strength at room temperature is about 167,000 psi. and a yield strength of 100,000 psi., while strength and ductility remain relatively high up to 1800° F. (Q23, Ni)

**962-Q. How Copper Alloys Behave at High Temperatures.** *Materials & Methods*, v. 44, Oct. 1956, p. 181-182, 184. (Translated from *Metallovedenie i Obrabotka Metallov*, 1955, no. 3, Sept. 1955, p. 32-38.)

Elevated-temperature properties of a number of Russian copper-base materials. (Q general, Cu, Ni)

**963-Q. A Laboratory for the High-Temperature Creep Testing of Metals and Alloys in Controlled Environments.** D. A. Douglas and W. D. Manly. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)*, ORNL-2053, Oct. 1956, 29 p.

Gaseous and vacuum testing machines, specimen design, operational problems, liquid-metal testing equipment, tube burst testing apparatus. (Q3)

**964-Q. Impact Behavior of Thorium.** J. A. Milko. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)*, ORNL-2122, Sept. 1956, 15 p.

Pure thorium behaves as a ductile material even at subzero temperatures. Addition of carbon results in presence of a transition temperature. Bomb-reduced thorium exhibits a ductile to brittle transition temperature. (Q6, Th)

**965-Q. Metals at Elevated Temperatures.** R. W. Guard. *Product Engineering*, v. 27, Oct. 1956, p. 160-164.

Hot and cold behavior of metals compared using homologous temperature scale, fatigue versus rupture stress as design criterion, predicting long-term properties from short-term tests. (Q general, P11)

**966-Q. Static Strength of Aluminum-Alloy Specimens Containing Fatigue Cracks.** Arthur J. McEvily, Jr., Walter Illg and Herbert F. Hardrath. *U. S. National Advisory Committee for Aeronautics, Technical Note* 3816, Oct. 1956, 54 p.

Seven specimens made of 2024 and 7075 alloys were subjected to repeated axial loads until cracks were formed. Method of analysis which predicts the observed results is described. (Q23, Q7, Al)

**967-Q. (English.) The Density, Magnetic Properties, Young's Modulus, and Δ E-Effect, and Their Change Due to Quenching in Ferromagnetic Iron-Aluminium Alloys. II. Young's Modulus and the Δ E-Effect.** Mikio Yamamoto and Satoshi Taniguchi. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 8, no. 3, June 1956, p. 193-204.

Measurements were made with the method of magnetostrictive vibration. (Q21, P10, P16, Fe, Al)

**968-Q. (French.) Influence of Hydrogen in Steels.** A. Kohn. *Metallurgie et la Construction Mécanique*, v. 88, no. 9, Sept. 1956, p. 717, 719-721.

A study of flakes and brittleness due to hydrogen in steels; remedies. (Q23, ST)

**969-Q. (French.) Behavior of Metallic Materials Under Complex Strains.** P. Laurent. *Metaux, Corrosion-Industries*, v. 31, no. 373, Sept. 1956, p. 355-368.

Study of metal fracture in machine parts in relation to metal properties. Various strain tests were considered and factors indicated for the choice of safety margins. (Q25, Q26)

**970-Q. (French.) Factors of Brittleness in Structural Steels.** P. E. Lagasse. *Revue de la Soudure (Brussels)*, v. 12, no. 3, 1956, p. 178-196.

Study of the structural alterations causing "transitions" in steels, in relation to the modern theories of formation and propagation of microfissures; some resulting principles in estimating steel brittleness. Transition curves of various tests performed on a series of steels, weldability of these steels. (Q23, N8, K9, ST)

**971-Q. (German.) Deformability of Sintered Iron.** P. Fischer and A. Steinegger. *Schweizer Archiv für Angewandte Wissenschaft und technik*, v. 22, no. 9, Sept. 1956, p. 290-293.

Effect of porosity of a powdered iron compact on its physical properties. (Q24, H14, Fe)

**972-Q. (German.) Investigation of Vibration Properties of Metals in an Ultrasonic Region at Higher Temperatures.** Hugo Josef Seemann and Herbert Staats. *Zeitschrift für Metallkunde*, v. 47, no. 9, Sept. 1956, p. 637-643.

A measuring arrangement which excites electrodynamically the fundamental axial vibration mode of cylindrical specimens. Natural frequency and damping capacity can be measured up to 1000° C. Results for duralumin, sintered aluminum, chromium-nickel-steels and a creep resistant chromium-nickel alloy. (Q8, Al, SS)

**973-Q.** (Russian.) **Brittle Fracture of Soldered "1 x 13" Steel.** I. A. Zaks, S. K. Zvegintsev and R. N. Il'ina. *Energomaschinostroenie*, 1956, no. 9, Sept. 1956, p. 15-19.

Detection of cracks in turbine blades, effect of metal components and soldering and heat treatment temperatures on joint strength. (Q26, K7, ST)

**974-Q.** (Russian.) **Analysis of Second-Order Stresses of the Alpha Phase of Quenched and Tempered Steel.** L. I. Lysak. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 624-630.

Experimental determinations show distortions to be the total effect of quench distortions, coherent distortions and dispersion distortions. (Q25, J26, AY)

**975-Q.** (Russian.) **X-Ray Study of Residual Stresses in Electrolytic Deposits of Nickel.** V. P. Moiseev and O. S. Popova. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 641-645 + 1 plate.

Orientation of stresses in the deposits, stress removal, lattice distortions and relation of hydrogen content. (Q25, M22, Ni)

**976-Q.** (Russian.) **Residual Change of Interfacial Distances in Polycrystalline Specimens After Plastic Deformation.** D. M. Vasilev and A. F. Erashov. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 659-663.

This residual change is revealed in soft steel both in the case of very small plastic deformations as well as after the application of a load not exceeding the macroscopic limit of elasticity. (Q24, M26, CN)

**977-Q.** (Russian.) **X-Ray Study of the Plastic Deformation of Metals During Static and Dynamic Compression.** T. N. Smirnova and Iu. S. Terminasov. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 664-670.

Mechanism of distortions of the atomic crystal lattice of metals subjected to compression. Negative role of residual distortions of crystal lattice as far as later fracture of the metal is concerned. (Q24, M26, Al, ST, Fe)

**978-Q.** (Russian.) **X-Ray Study of Phenomena Accompanying High-Temperature Creep of Steel.** M. Ia. Fuks, N. V. Slonoskii and L. I. Lupilov. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 671-675.

Relation of dimensions of mosaic blocks and microstresses to the character of the deformation, rate of deformation and temperature. (Q3, AY)

**979-Q.** (Russian.) **X-Ray Analysis of Structural Changes in Metals During Creep.** L. M. Rybakova. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 676-678 + 2 plates.

Varying degrees and rates of deformation in Armco iron specimens at room temperature and 450° C. (Q3, Fe)

**980-Q.** (Russian.) **Effect of Texture on the Intensity of Interference Lines in the Study of Large-Sized Deformed Specimens.** M. Ia. Fuks and G. V. Dobrovol'skaia. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 679-683.

Study of microdistortions in the crystal lattice in rolled specimens. Relation of intensity to degree of deformation at different loads. (Q24, AY)

**981-Q.** (Russian.) **Secondary Hardness in Steels Alloyed With Vanadium, Molybdenum or Titanium.** L. V. Zaslavskaia, S. T. Kishkin, N. F. Lashko, A. F. Platonova, N. M. Popova and M. F. Rybina. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 684-688.

Relation of hardness and amount of vanadium (in high-dispersion vanadium carbide) to tempering temperature and composition of steel. Same relation for titanium and for molybdenum. (Q29, J29, AY)

**982-Q.** (Russian.) **X-Ray Study of the Quality of the Surface on Finely Ground and Machined Metals.** Iu. S. Terminasov, A. G. Iakhontov and A. V. Poltavskii. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 689-692.

Parallels in structural changes and microhardness between a finely machined surface and the surface produced by grinding and polishing. Dislocations and distortions in lattice and reduction in size and deformation. (Q29, M26, G18)

**983-Q.** (Russian.) **Mechanism of the Effect of Small Additions on the Formation of Recrystallization Textures in Metals and Alloys.** D. I. Lainer and E. I. Krupnikova. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 693-694.

Properties required of additives to minimize anisotropic tendencies. Factors affecting preferred orientation. (Q24, N5, Al, Cu, Ni)

**984-Q.** (Russian.) **Residual Stresses in Metals After Grinding.** O. G. Karpinskii and B. M. Levitskii. *Izvestiia Akademii Nauk SSSR, Seriia Fizicheskaia*, v. 20, no. 6, June 1956, p. 700-702.

Distribution of residual stresses in surface layers of Armco iron specimens after grinding. Values of second order residual stresses. (Q25, G18, Fe-a)

**985-Q.** (Russian.) **Hardenability and Distribution of Hardness at a Cross Section of a Hardened Steel Body.** M. E. Blanter and A. A. Goldenberg. *Metallovedenie i Obrabotka Metallov*, no. 8, Aug. 1956, p. 12-20.

Develops and experimentally tests a method for determining distribution or hardness over a cross section of a steel article without cutting through it. Develops nomograms for practical application of the method. (Q29, ST)

**986-Q.** (Russian.) **The Effects of Various Types of Treatment on the Fatigue Strength of E1434 Steel.** B. I. Aleksandrov and A. P. Shishkova. *Metallovedenie i Obrabotka Metallov*, no. 8, Aug. 1956, p. 20-27.

Various tests for determining effects of treatment. Most effective means for increasing fatigue strength in cold working or surface peening. (Q7, AY)

**987-Q.** (Russian.) **The Effects of Heat Treatment on the Blue Brittleness of Structure Steel.** G. I. Pogodin-Alekseev and M. M. Fetisova. *Metallovedenie i Obrabotka Metallov*, no. 8, Aug. 1956, p. 31-37.

Tests made on steel 55. Blue brittleness begins at about 340° C. and reaches maximum value at 540° C. Effects of blue brittleness at various temperatures on the plasticity and impact strength. (Q23, Q7, AY)

**988-Q.** (Russian.) **Naphthalene Type Fracture in High Speed Steel.** L. B. Getsov. *Metallovedenie i Obrabotka Metallov*, no. 8, Aug. 1956, p. 42-43.

Discussion of the defect. A method for reclaiming articles which are subject to failure from naphthalene fracture. (Q26, TS)

**989-Q.** (Russian.) **Testing the Deformation Properties of Commercial Cast Steel.** G. N. Mekhed. *Metallovedenie i Obrabotka Metallov*, no. 8, Aug. 1956, p. 43-47.

Effects of temperature and chemical properties on plastic properties of killed and rimmed cast steel. (Q23, CI)

**990-Q.** (Spanish.) **Chemical Composition, a Probable Indication of the Mechanical Quality of Gray Spiegel Iron.** J. Navarro-Alcacer. Paper from "XXVIII Congreso Internacional de Quimica Industrial". v. I. Saez, p. 563-568.

Study of a probable relation between the chemical composition understood as "index of saturation" and the various coefficients of mechanical resistance, especially the ultimate tensile strength. (Q23, CI)

**991-Q. The Measurement of the Thermal Stability of Titanium Alloys.** F. R. Schwartzberg, W. D. Rahr, D. N. Williams and R. I. Jaffee. *Battelle Memorial Institute, Titanium Metallurgical Laboratory Report* No. 55, Oct. 1956, 30 p.

Effects of variations in stress and strain during exposure, time and temperature of exposure, hydrogen content and surface contamination on room-temperature mechanical properties. (Q general, Ti)

**992-Q. Some Considerations of Wear in Marine Gearing.** W. H. Darlington. *Institute of Marine Engineers, Transactions*, v. 58, Sept. 1956, p. 289-308.

Design, manufacture and operation of three sets of marine double reduction gears. (Q9)

**993-Q. Effect of Finishing Temperatures on Properties of Hot Rolled Steel Plate.** R. H. Frazier, F. W. Boulger and C. H. Lorig. *Iron and Steel Engineer*, v. 33, Oct. 1956, p. 67-79.

Resistance of hot rolled steel plate to brittle fracture can be increased by lowering the finishing temperature. After normalizing, aluminum-killed steels have finer ferrite grain size than semikilled steels. Lowering finishing temperature also raises yield strength and produces smaller ferrite grain size. (Q26, Q23, F23, ST)

**994-Q. Variation in Fatigue Properties Over Individual Casts of Steel. I. Investigation of a Cast of Steel to B.S. 970 Specification En. 100.** E. Ineson, J. Clayton-Cave and R. J. Taylor. *Iron and Steel Institute, Journal*, v. 184, Oct. 1956, p. 178-185.

Investigation to establish whether or not the fatigue properties of the rolled products of commercial steel ingots vary significantly within an individual ingot and from ingot to ingot in a given cast of steel. (Q7, CI)

**995-Q. Effect of Melting and Casting Atmospheres on Cast Nickel Alloys.** C. M. Hammond and R. A. Flinn. *Journal of Metals*, v. 8, sec. 1, Oct. 1956, p. 1450-1456.

Rupture strength and elongation determined at elevated temperatures. Increased strength was most pronounced in high-boron alloys of the Guy type, while improvement in ductility was apparent in all cases. (Q4, E25, Ni)

**996-Q. Observations on Mechanical Properties of Hydrogenated Vanadium.** B. W. Roberts and H. C. Rogers. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1213-1215.

Vanadium foils and wires, either cold worked or recrystallized, show a ductile-brittle-ductile fracture sequence with temperature. (Q23, N15, V)

**997-Q. Creep of Polycrystalline Nickel.** J. Weertman and P. Shahinian. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1223-1226.

Nickel samples were measured in the stress region of $2.5 \times 10^7$ to $2.8 \times 10^9$ dyne per sq. cm. and the temperature region of 400 to 1100° C. Activation energy of creep is approximately 65,000 cal. per mol. (Q3, Ni)

**998-Q. Constant Strain Rate Bend Tests on Hydrogen-Embrittled High Strength Steels.** W. Beck, E. P. Klier and G. Sachs. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1263-1268.

Mechanical tests used to determine effects of hydrogen embrittlement on the strength and ductility of steels. (Q5, Q23, AY)

**999-Q. High Damping Ferromagnetic Alloys.** A. W. Cochardt. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1295-1298.

Wires of 55 binary and ternary cobalt, iron, nickel and chromium alloys were twisted and the decay of the free torsion vibration was measured at torsion stresses between 500 and 8000 psi. (Q8, Fe)

**1000-Q. Structural Changes in Molybdenum Single Crystals Due to Cold Rolling.** N. Ujiiye and R. Maddin. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1298-1304.

Lattice rotations for various degrees of rolling were observed. Relationships between initial and end orientations were analyzed. (Q24, Mo)

**1001-Q. Effect of Plastic and Elastic Stresses on the Losses and the Domain Configurations of Grain-Oriented 3 Pct. Si-Fe.** P. W. Neurath. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1319-1324.

Permanent, plastic elongation of about 0.1% almost doubles the 60-cycle watt losses. Subsequent application of tension in the elastic range eliminates this loss increase. (Q21, Q23, P17, TS)

**1002-Q. Plastic Anisotropy of Zinc Monocrystals.** John J. Gilman. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1326-1336.

Glide on the basal and prismatic planes of monocrystals was investigated at 250 to 400° C. Prismatic glide obeys Schmid's law. Creep of polycrystalline zinc is controlled by prismatic glide at high temperatures. (Q3, M26, Zn)

**1003-Q. Nonoctahedral Slip in Aluminum.** T. Ojala, C. Elbaum and W. C. Winegard. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1344-1345.

Reports the observation of characteristics in the grain boundary region of an aluminum bicrystal and tricrystal, both deformed in tension at room temperature. (Q24, Al)

**1004-Q. Ti-36 Pct. as a Base for High-Temperature Alloys.** Joseph B. McAndrew and H. D. Kessler. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1348-1353.

An experimental survey of the oxidation resistance, stress-rupture strength, creep and impact strength at elevated temperature. (Q3, Q4, Q6, R2, Ti, Al)

**1005-Q. Variations in Radiation Damage to Metals.** C. A. Bruch, W. E. McHugh and R. W. Hockenbury. *Journal of Metals,* v. 8, sec. 2; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1362-1372.

Groups of metals were irradiated at approximately equal exposure conditions in the Materials Testing Reactor. Measurements were made of some mechanical and physical properties to determine the extent of damage. (Q general, P15, M26)

**1006-Q. Development of Nickel-Chromium Base Alloys for High-Temperature Service. II. Creep, Rupture and Other Properties.** W. Betteridge and A. W. Franklin. *Metal Treatment and Drop Forging,* v. 23, Oct. 1956, p. 385-389.

Progressive improvement in Nimonic alloys has resulted in increasing resistance to creep and rupture at elevated temperatures. Corresponding improvement in fatigue strength and in short-time tensile and torsion properties is associated with increasing creep resistance. (Q3, Q4, Ni)

**1007-Q. Internal Friction Methods Applied to Metallurgical Problems. II. Practical Applications.** W. R. Thomas and G. M. Leak. *Metal Treatment and Drop Forging,* v. 23, Oct. 1956, p. 413-419.

Application of technique to study of interstitial solutions, movement of lattice dislocations during stressing and relaxation of stress across a grain boundary. (Q22, M26, M27)

**1008-Q. Final Report—Development and Testing of Vacuum Melted Nickel-Molybdenum Alloys With Minor Alloying Additions.** O. Preston, N. J. Grant and C. F. Floe. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission),* ORNL-2181, Oct. 1956, 37 p.

Stress-rupture tests, tensile tests and metallographic examination of various compositions indicate degree of stabilization conferred by additions of chromium, iron, vanadium and columbium. (Q4, Q23, N6, Mo, Ni)

**1009-Q. On the Theory of the Low-Temperature Internal Friction Peak Observed in Metals.** Alfred Seeger. *Philosophical Magazine,* v. 1, ser. 8, no. 7, July 1956, p. 651-662.

The relaxation phenomenon is thought to be due to dislocations which are confined by the Peierls stress to certain crystallographic directions. Under combined action of thermal fluctuations and applied stress they may form pairs of kinks. (Q22, M26)

**1010-Q. A Fixture for Testing Sheet Materials in Compression at Elevated Temperatures.** D. C. Hayward. *Royal Aeronautical Society, Journal,* v. 60, Oct. 1956, p. 669-674.

A fixture for testing under edgewise compression sheet materials up to temperatures of 400° C. Tensile and compressive properties of titanium and aluminum materials. (Q25, Q28, Al, Ti)

**1011-Q. The Effect of Stress Concentrations on the Fatigue Resistance of a Duralumin Type Aluminum Alloy.** J. Y. Mann. *Royal Aeronautical Society, Journal,* v. 60, Oct. 1956, p. 681-685.

Fatigue curves were established under a wide range of theoretical stress concentration factors. Notch sensitivity is assessed. (Q7, Al)

**1012-Q. How Much Does Lead Change Steel?** *Steel,* v. 139, Oct. 29, 1956, p. 122-123.

Results of tests on C-1050 and C-1141 steels. Impact transition temperatures average 22° F. lower. (Q6, Pb, ST)

**1013-Q. Impact Performance of Synthetically Reproduced Heat-Affected-Zone Microstructures in "T-1" Steel.** Ernest F. Nippes and Craig R. Sibley. *Welding Journal,* v. 35, Oct. 1956, p. 473s-480s.

Laboratory investigation indicates that, based on results with particular heat tested, "T-1" steel is not embrittled by the thermal cycles of welding. (Q6, Q23, N8, K1, ST)

**1014-Q. Some Effects of Minor Elements on the Characteristics of Plain-Carbon Steels.** Francis W. Boulger. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 393-400, 419-420.

Effects of sulphur, phosphorus and nitrogen on the properties of low and medium-carbon steels. (Q general, P general, CN)

**1015-Q.** (English.) **Some New Problems Arising From Electron Microscope Studies of the Plastic Deformation of Metals.** A. F. Brown. *Revue Universelle des Mines,* v. 12, ser. 9, no. 10, Oct. 1956, p. 501-507.

Significance of surface phenomena as well as subsurface conditions related to plastic deformation. (Q24)

**1016-Q.** (Czech.) **Contribution to the Comparison of the Czechoslovak Carburizing Steels.** Rudolf Stefec and Jaroslav Dobry. *Hutnické Listy,* v. 11, no. 9, Sept. 1956, p. 536-541.

The impact resistance of 10 carburized steels at room temperatures and below, before and after carburizing, were determined. (Q6, J28, ST)

**1017-Q.** (Czech.) **Evaluation of Creep Tests.** Rudolf Pospisil. *Hutnické Listy,* v. 11, no. 9, Sept. 1956, p. 547-552.

Enlarges on the method proposed by Larson and Miller for evaluation of tests in several alloy steels. (Q3, AY)

**1018-Q.** (French.) **Stress Analysis by Photo-Elastic Varnishes.** F. Zandman. *Acier, Stahl, Steel,* v. 21, no. 9, Sept. 1956, p. 356-364.

Varnishes considered are prepared in liquid form and applied by brushing, spraying or dipping, or are prepared in form of sheets of constant thickness and cemented on test surfaces. (Q25, CN, SS)

**1019-Q.** (French.) **A Study on Preferential Orientations in Copper as Extruded, Stretched and Annealed.** Paul Bastien and Jean Pokorny. *Revue de Métallurgie,* v. 53, no. 9, Sept. 1956, p. 649-659.

X-ray examination shows the existence of a double texture, one part of which weakens during recrystallization at increasing temperatures, and grows much stronger at high temperatures. (Q24, N5, Cu)

**1020-Q.** (French.) **A Study of Mechanical Properties at Very High Temperatures.** C. Boulanger and C. Crussard. *Revue de Métallurgie,* v. 53, no. 9, Sept. 1956, p. 715-728.

A special apparatus was built to record the effort-deformation cycles from room temperature up to 1550° C. (Q24)

**1021-Q.** (German.) **Creep Phenomena in Metals Under Load.** W. Späth. *Metall,* v. 10, no. 19-20, Oct. 1956, p. 910-915.

Elementary processes in metals under load, initiation and effect of ultrasonic waves, heating of plastically deformed materials, phenomena during creep. (Q3)

**1022-Q.** (German.) **Impact Resistance of Titanium.** O. Rüdiger and W. Knorr. *Technische Mitteilungen Krupp,* v. 14, no. 4, Sept. 1956, p. 105-113.

Effect of temperature, shape and direction of rolling. Impact resistance of pure titanium; effect of impurities and of hydrogen. (Q6, Ti)

**1023-Q.** (German.) **Change in Mechanical and Technological Properties of Titanium Wires After Cold Drawing.** A. Pfützenreuter. *Technische Mitteilungen Krupp,* v. 14, no. 4, Sept. 1956, p. 115-120.

Experimental data; comparison with data on stainless steel properties. (Q general, F28, Ti, SS)

**1024-Q.** (Polish.) **Properties of Chromium Steel of the Type 15H (CCl) for Carburizing.** S. Orzechowski and C. Gawin. *Prace Instytutow Ministerstwa Hutnictwa,* 1956, no. 3, p. 117-154.

Changes in properties were analyzed in relation to the conditions of second hardening and were correlated with the changes taking place at the same time in the structure of steel. (Q general, J28, AY)

**1025-Q.** (Polish.) **Heat Treatment of Pearlitic Malleable Cast Iron.** Mikolaj Dubowicki, Waclaw Sakwa and Stefan Pieprznik. *Przeglad Odlewnictwa,* v. 6, no. 9, Sept. 1956, p. 258-267.

Establishes mechanical properties of pearlitic iron as influenced by temperature and time of heating before hardening as by annealing. (Q23, J23, CI)

**1026-Q.** (Russian.) **Methods of Testing Metallic Specimens With Different Stress Concentration in Static and Impact Torsion.** N. G. Mikhailichenko. *Zavodskaia Laboratoriia,* v. 22, no. 9, Sept. 1956, p. 1081-1086.

A method of torsion testing which produces a nonuniform stress distribution. (Q1)

**1027-Q.** (Russian.) **Methods of Determining the Relationship Between the Propagation Velocities of the Plastic and the Elastic Deformation.** D. A. Kal'ner. *Zavodskaia Laboratoriia,* v. 22, no. 9, Sept. 1956, p. 1086-1089.

An experimental basis for, and a method of computing the velocity of propagation of plastic deformation in metals from the known propagation velocity of elastic deformation, which is equal to the velocity of sound in the material. (Q21, Q24)

**1028-Q.** (Russian.) **Bend Testing of Specimens With Stress Concentrations.** E. S. Volokhvianskaia. *Zavodskaia Laboratoriia,* v. 22, no. 9, Sept. 1956, p. 1095-1098.

Bend testing of specimens of a configuration conducive to nonuniform stress concentrations provides an independent additional characteristic of the serviceability of a metal. (Q5, ST)

**1029-Q.** (Russian.) **Certain Regularities of Mechanical Strength of Products Obtained by Sintering of Powdered Metals.** B. I. Pines and N. I. Sukhinin. *Zhurnal Tekhnicheskoi Fiziki,* v. 26, no. 9, Sept. 1956, p. 2076-2085.

Relation between tensile strength, porosity and temperature. Values for copper; $\beta$:n ratio. (Q27, H15, Cu)

**1030-Q.** (Russian.) **X-Ray Study of the Nature of Destruction Under an Impact Load.** D. M. Vasil'ev, G. I. Margolin and S. V. Dianov. *Zhurnal Tekhnicheskoi Fiziki,* v. 26, no. 9, Sept. 1956, p. 2119-2124.

Relation between second degree distortion on impact and force of destruction. Method of detection. (Q6)

**1031-Q. Formability of Metals. II. The Carbon Steels.** Lester F. Spencer. *Finish,* v. 13, Nov. 1956, p. 44, 46-48.

Basic characteristics of metals, materials for cold forming, and divisions of cold forming methods analyzed. (To be continued.) (Q23, G general, CN)

**1032-Q. Magnesium Alloy Moves Temperature Barrier Upward.** R. E. Bockrath. *Iron Age,* v. 178, Nov. 1, 1956, p. 98-101.

Thorium-bearing magnesium alloy exhibits acceptable tensile properties up to 600° F. in extended service, 800° F. in short exposures. (Q23, Mg)

**1033-Q. Effect of Hydrogen on Alpha Titanium Alloys.** G. A. Lenning, J. W. Spretnak and R. I. Jaffee. *Journal of Metals,* v. 8, sec. 2; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1235-1240.

The effect of up to 200 ppm. on the microstructure and mechanical properties of high-purity titanium containing oxygen, nitrogen, tin and aluminum. Increasing the hydrogen content resulted in precipitation of a hydride phase and decreased notch-bend impact strength. (Q23, Q6, N7, M27, Ti)

**1034-Q. Some Observations on the Structure of Grain Boundary Fracture Surfaces.** H. C. Chang and Nicholas J. Grant. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, sec. 2, Oct. 1956, p. 1241-1247.

A 20% Zn-Al alloy fractured in an intercrystalline manner both in creep tests at 500° F. and tensile tests. The fracture surfaces studied by microscopy and X-rays were made up of fracture facets. (Q26, M27, Zn, Al)

**1035-Q. Influence of Silicon and Aluminum on the Properties of Hot Rolled Steel.** R. H. Frazier, F. W. Boulger and C. H. Lorig. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, sec. 2, Oct. 1956, p. 1269-1276.

Silicon added to steel acted as a deoxidizer and lowered the ductile-brittle transition temperature of the steel plate. Increasing aluminum contents up to 0.20% lowered the transition temperature at a rate depending on the amount of silicon and manganese present. (Q23, ST)

**1036-Q. Effect of Mo, W, and V on the High Temperature Rupture Strength of Ferritic Steel.** A. E. Powers. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, sec. 2, Oct. 1956, p. 1373-1377.

Both high and low testing temperatures were considered. Results were correlated with effectiveness of the alloying elements in the form of carbides and in solid solution. Tempering behavior was also studied. (Q4, J29, AY)

**1037-Q. Activation Energy for High Temperature Creep of High Purity Aluminum.** H. I-Lieh Huang, O. D. Sherby and J. E. Dorn. *Journal of Metals.* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, sec. 2, Oct. 1956, p. 1385-1388.

New technique used, involving rapid changes of temperature. Activation energy was found to be 32,200 ± 1770 cal. per mol., insensitive to stress over the range of approximately 580 to 3500 psi., and insensitive to strain up to 40%. (Q3, Al)

**1038-Q. Some Creep Tests on Steels for Prestressed Concrete.** G. M. Canta. *Metaalinstituut T. N. O.,* no. 39, June 1956, 12 p.

Some 30 creep tests in which the stresses were varied over a wide range of values. Steels investigated were cold drawn steel wire, cold drawn and aged steel wire, and hardened and tempered steel wire. (Q3, ST)

**1039-Q.** (English.) **The Influence of Temperature on Pre-Yield Plastic and Anelastic Microstrain in Low Carbon Steel.** J. A. Hendrickson, D. S. Wood and D. S. Clark. *Acta Metallurgica,* v. 4, no. 6, Nov. 1956, p. 593-601.

Rates of pre-yield microstrain when stress is first applied are compared with the theoretical rates for the thermally activated release of dislocations from atmospheres of interstitial solute atoms. (Q21, Q23, CN)

**1040-Q.** (Russian.) **The Influence of Thermomechanical Treatment on the Cold Shortness of Alloy Structural Steels.** E. N. Sokolkov. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 79-82.

Recrystallization was suppressed by lowering rolling temperature and reducing the interval between the end of rolling and the hardening to 1 to 2 sec. (Q23, F23, AY)

**1041-Q.** (Russian.) **A Study of Step-Wise Deformation by the Electrical Conductivity Method.** V. N. Rozhanskii, Iu. V. Goriunov, and E. D. Shchukin. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 113-126.

Methods and results of measuring electrical resistance changes at the time of occurrence of deformation slips in zinc single crystals. Some of the results are treated in the light of the dislocation concept. (Q24, M26, Zn)

**1042-Q.** (Russian.) **On the Plasticity Laws.** I. N. Vinogradov and Iu. I. Iagn. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 127-134.

Derives approximation formulas for computing deformation from a given stress for beryllium bronze and pure iron. (Q23, Q24, Be, Cu, Fe)

**1043-Q.** (Russian.) **Destruction of Aluminum Bronze Specimens.** I. N. Vinogradov and Iu. I. Iagn. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 135-138.

Yield points of aluminum bronze specimens in linear, bi-axial and tri-axial compression and in linear tension. (Q23, Cu)

**1044-Q.** (Russian.) **Temperature Mosaics and the Instantaneous Secondary Stresses in Impact Deformation of Two-Phase Metals.** G. P. Zaitsev and Iu. E. Bondarev. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 139-145.

Calculation of instantaneous secondary stresses developing when the phases or various structural constituents differ with respect to their resistance to plastic deformation. (Q6, Q24)

**1045-Q.** (Russian.) **On the Initial Stage of Plastic Deformation in Polycrystalline Metals and the Influence of the Grain Size. I. Aluminum. II. Iron.** Ia. R. Rauzin, and A. R. Zhelezniakova. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 146-161.

A study of the first and second intergrain stages of deformation of polycrystalline metals. Peculiarities of the process in the cases of aluminum and iron. (Q24, Al, Fe)

**1046-Q.** (Russian.) **Determination of Susceptibility of Structural Ferritic Steels to Cold Shortness From the Tension Test Data for Flat Specimens.** P. O. Pashkov and V. A. Bratukhina. *Fizika Metallov i Metallovedenie,* v. 3, no. 1, 1956, p. 162-171.

An attempt on the basis of tensile data for standard flat specimens at changing temperatures, to investigate the susceptibility to brittleness of ordinary alloyed and nonalloyed structural steels. Plasticity change at dropping temperatures studied as a parameter most indicative of the susceptibility to cold shortness. (Q27, Q23, ST)

**1047-Q.** (Russian.) **The Effect of Certain Alloying Elements on the Susceptibility of Steel to Temper Brittleness.** M. L. Bernshtein. *Metallovedenie i Obrabotka Metallov,* no. 9, Sept. 1956, p. 25-30.

Investigates susceptibility of steels to temper brittleness by tests for impact strength to determine the thresholds of cold shortness for ductile and brittle specimens. (Q23, ST)

**1048-Q.** (Russian.) **Increasing the Contact Fatigue Strength of Steel Plates by Surface Cold Working.** I. V. Kudriavtsev and N. M. Savvina. *Metallovedenie i Obrabotka Metallov,* no. 9, Sept. 1956, p. 31-41.

A study of the fatigue strength in contact zones of steel plates 50 mm. thick and of improving this strength by cold working. (Q7, G general, ST)

**1049-Q.** (Russian.) **Ways of Detecting Woody Fracture.** M. I. Gol'dshtein. *Stal',* v. 16. no. 9, Sept. 1956, p. 809-811.

Woody fracture is related to the laminar inhomogeneity of metal structure . (Q26, ST)

**1050-Q.** (Russian.) **Anisotropy of Mechanical Properties of Steel Ingots Melted and Poured Under Vacuum.** Ia. B. Gurevich. *Stal',* v. 16, no. 9, Sept. 1956, p. 815-817.

A comparison of the mechanical properties of steel specimens cut from differently oriented portions of a column-shaped ingot. Vacuum melted and poured carbon steels and alloyed austenitic steel. (Q general, D8, CN, AY)

**1051-Q.** (Russian.) **Mechanical Properties of Cold Worked Steel Wire.** K. I. Tulenkov, M. I. Zlotnikov and S. F. Bobyleva. *Stal',* v. 16, no. 9, Sept. 1956, p. 821-825.

Nomograms, based on theory and experiments, which serve for a quick determination of the mechanical properties of carbon steel wire from the initial parameters of its production, and vice versa. (Q23, CN)

**1052-Q.** (Book.) **Bibliography on Low Temperature Characteristics of Steels, 1904-1954, With Author Index.** Katherine Janis. Rev. Ed., 56 p. 1955. The International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.

564 references. (Q general, ST)

# R

## Corrosion

**498-R. Effect of Hydrogen Pickup on Corrosion Behavior of Zirconium in Water.** Charles M. Schwartz and Dale A. Vaughan. *Battlle Memorial Institute (U. S. Atomic Energy Commission),* BMI-1120, Aug. 1956, 17 p.

Metallographic study of cross sections after exposure of zirconium to 750° F. steam revealed the growth of hydride needles. Incipient formation of layer between the metal and the oxide was observed in crystal-bar zirconium. (R4, Zr)

**499-R. Effect of Sulfide Scales on Catalytic Reforming and Cracking Units. I. Metallographic Examination of Samples From a Catalytic Reforming Unit. II. Intergranular Corrosion of 18-8 Cr-Ni Steel as a Result of Hydrolysis of Iron Sulfide Scale.** *Corrosion,* v. 12, Oct. 1956, p. 73-76.

Determined that high-temperature hydrogen sulphide-hydrogen corrosion is an intergranular progression. Alloy corrosion was due to action of moist sulphide scale during downtime. (R6, R2, AY, SS)

**500-R. Nature of Stress Corrosion Cracking of Stainless Steels When Other Types of Corrosion Are Present.** W. G. Renshaw. *Corrosion,* v. 12, Otc. 1956, p. 447-478.

Three cases examined point to some factor of a localized nature which precedes actual transgranular cracking, and probably acts to initiate it. (R1, SS)

**501-R. Aqueous Corrosion of Aluminum. II. Methods of Protection Above 200° C.** J. E. Draley and W. E. Ruther. *Corrosion,* v. 12, Oct. 1956, p. 480-490.

An alloy containing approximately 1% nickel was developed which is safe against attack up to 350° C. (R4, Ni, Al)

**502-R. Application of the Statistical Theory of Extreme Values to the Analysis of Maximum Pit Depth Data for Aluminum.** P. M. Aziz. *Corrosion,* v. 12, Oct. 1956, p. 495-506.

Maximum depths obtained on each of replicate samples analyzed by the theory of extreme values. (R2, Al)

**503-R. The Structure of Oxide Scales on Chromium Steels.** H. J. Yearian, E. C. Randell and T. A. Longo. *Corrosion,* v. 12, Oct. 1956, p. 515-525.

Structural analyses of alloys containing 5 to 26% chromium when oxidized in air or oxygen at temperatures from 700 to 1160° C. up to 100 hr. determined by X-ray diffraction methods. (R2, AY)

**504-R. Association of $Co^{60}$ Ions With Metal Surfaces.** R. T. Foley, B. T. Stark and C. J. Guare. *Electrochemical Society, Journal,* v. 103, Oct. 1956, p. 534-538.

Technique readily demarks areas that are cathodic to adjacent areas. Steel-copper and aluminum-copper couples were observed, and the strong attraction of radiocobalt to the cathode member of the couple was measured. (R1, Fe, Cu, Al, Co)

**505-R. A Mechanism for the Anodic Dissolution of Magnesium.** J. H. Greenblatt. *Electrochemical Society, Journal,* v. 103, Oct. 1956, p. 539-543.

Magnesium in the anolyte and in the corrosion product, total hydrogen evolved, and weight loss were determined. (R2, Mg)

**506-R. Mathematical Studies of Galvanic Corrosion. VI. Limiting Case of Very Thin Films.** J. T. Waber. *Electrochemical Society, Journal,* v. 103, Oct. 1956, p. 567-570.

Limiting case of very thin electrolyte layer which covers coplanar electrode arrangement was analyzed by making electrode dimensions infinitely larger than corrodent depth. (R1)

**507-R. Oxidation of Alloys Involving Noble Metals.** Carl Wagner. *Electrochemical Society, Journal,* v. 103, Oct. 1956, p. 571-580.

Diffusion processes during the oxidation of alloys are analyzed. Oxidation rate of scale consisting of protruding sections of the oxide of the less noble metal interspersed with slender trunks of alloy rich in the more noble metal was calculated. (R2, EG-c)

**508-R. Field Corrosion Tests in Purex Acid Uranium and Waste Concentrators.** N. D. Groves and K. M. Haws. *Hanford Atomic Products Operation (U. S. Atomic Energy Commission),* HW-42884, June 1956, 10 p.

Corrosion data on 304-L and 347 stainless steels, 308-L and 347 welding alloys currently in use for heat exchanger construction. (R6, SS, U)

**509-R. The Inhibitor I.F.P. 550.** *Industrial Finishing,* v. 9, Sept. 1956, p. 109-110; 112-113.

Inquiry into the inhibition of acid attack on metals resulted in the production of a new inhibitor. (R10)

**510-R. Experimental Procedures Used for the Measurement of Corrosion and Metal Transport in Fused Sodium Hydroxide.** G. P. Smith, M. E. Steidlitz and E. E. Hoffman. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission),* ORNL-2125, Oct. 1956, 6 p.

Techniques for studying corrosion reactions and mass transfer at temperatures up to 815° C. Apparatus is designed for small-scale testing. (R11)

**511-R. Corrosion; A Bibliography of Unclassified Report Literature.** *U. S. Atomic Energy Commission, TID-3302,* July 1956, 36 p.

Contains 111 annotated references to unclassified reports on the corrosion of alloys, commercial alloys, ceramics and plastics. (R general)

**512-R. Interdependence of Various Inhibition Mechanisms in Metals.** Jean Frasch. Paper from "XXVIII Congreso Internacional de Quimica Industrial". v. I. Saez, p. 348-354.

Interpretation of the inhibition of corroding media; colloidochemical theory. (R10)

**513-R.** (French.) **A Corrosion Problem in Evaporators. Action of Caustic Alkalies on Nickel.** P. A. Helmbold. *Corrosion et Anticorrosion,* v. 4, no. 8, Sept. 1956, p. 271-275.

Determining various values of cathodic protection of nickel against the corrosive action of caustic alkalies requires a perfect knowledge of the factors determining the amount of corrosion. Some factors defined. (R5, R10, Ni)

**514-R.** (French.) **Mechanical and Metallurgical Factors of Humid Metal Corrosion. Relationship Between Intergranular Corrosion and the Structure of the Grain Joints.** P. Lacombe. *Métaux, Corrosion-Industries,* v. 31, no. 373, Sept. 1956, p. 337-354.

Structural and mechanical causes of electrochemical corrosion and remedies. Comparison of 70-30 brass with 18-8 stainless steel and aluminum-magnesium alloys in respect to corrosion. Attraction of atoms of impurities by grain joints as essential causes of metal and alloy brittleness. (R1, R2, Cu, Al, Mg, SS)

**515-R.** (French.) **Protection of Buried Pipes Against Corrosion.** J. Callais. Paper from "XXVIII Congreso Internacional de Quimica Industrial". v. I. Saez, p. 336-342.

Pipelines in Southwestern France protected against soil action by cathodic protection; efficiency of the method. (R10, ST)

**516-R.** (French.) **Toward a New Hypothesis on Intergranular Corrosion of Austenitic Stainless Steels.** J. Hochmann. Paper from "XXVIII Congreso Internacional de Quimica Industrial". v. I. Saez, p. 364-366.

A heterogeneous composition and high carbon concentration may exist in the crystal boundaries of 18-8 stainless steels. During welding, carbons and carbides are precipitated "in situ" with no chromium diffusion. (R2, SS)

**517-R.** (Italian.) **Action of Some Organic Compounds on Acid Dissolution of Monocrystalline Zinc of High Purity.** L. Cavallaro and G. P. Bolognesi. *Metallurgia Italiana,* v. 48, no. 9, Sept. 1956, p. 393-400.

Effects of the "wetting" factor on the dissolution of the (0001) surface of zinc in presence of sulphuric acid. Inhibitors used included thiourea derivatives and some isosulphocyanates, together with ethyl alcohol. (R10, R6, Zn)

**518-R.** (Russian.) **Effect of Certain Organic Compounds on the Solubility Ratio of Carbon Steel in Inorganic Acids.** S. A. Balezin and M. A. Ignat'eva. *Doklady Akademii Nauk SSSR,* v. 109, no. 4, Aug. 1, 1956, p. 771-773.

Effect of inhibitors on corrosion of steel in sulphuric and hydrochloric acids. (R10, R6, ST)

**519-R.** (Russian.) **The Mechanism of Corrosion Cracking in Austenitic Steels.** A. V. Riabchenkov and V. M. Nikiforova. *Metallovedenie i Obrabotka Metallov,* no. 8, Aug. 1956, p. 2-11.

Electrochemical factors are very important in initiating and developing corrosion cracking. Claims a potential difference is the basic cause of failure. (R1)

**520-R.** (Spanish.) **Tests on the Sensitiveness to Intercrystalline Corrosion of 18-8 Stainless Steels.** Francisco Joanxich Ayma. Paper from "XXVIII Congreso Internacional de Quimica Industrial". v. I. Saez, p. 367-371.

Preparation of test samples, study of various processes and comparison of results aiming to simplify corrosion tests for stainless steels and to reduce the testing time from 48 hr. to 15 or 20 min. (R11, R2, SS)

**521-R. The Reactions of Molten Sodium Hydroxide With Various Metals.** D. D. Williams, J. A. Grand and R. R. Miller. *American Chemical Society, Journal,* v. 78, Oct. 20, 1956, p. 5150-5155.

Chemical reaction data on metal-sodium hydroxide systems which explain corrosion and mass transfer in such systems. (R6)

**522-R. The Protection of Cable Sheathing. The "Phenol Corrosion" of Lead.** E. L. Coles and R. L. Davies. *Chemistry & Industry,* 1956, no. 39, Oct. 6, 1956, p. 1030-1035.

Corrosion previously ascribed to phenolic compounds may be caused by low molecular weight aliphatic acids. Factors leading to corrosion associated with coal tar impregnants are indicated. (R7, Pb)

**523-R. The Protection of Cable Sheathing. Cathodic Protection of Telecommunication Cables.** J. Gerrard and J. R. Walters. *Chemistry & Industry,* 1956, no. 40, Oct. 13, 1956, p. 1060-1068.

The incidence of and methods of combating corrosion damage to telecommunication cables. Electrical surveys and instrumentation. (R10, Pb)

**524-R. The Protection of Cable Sheathing. The Protection of Buried Power Cables Against Corrosion.** *Chemistry & Industry,* 1956, no. 4, Oct. 13, 1956, p. 1069-1076.

Investigation of cases in which corrosion occurred enabled necessary remedial measures to be determined and indicated causative conditions. (R10)

**525-R. The Stress-Corrosion Cracking of Austenitic Stainless Steels. II. Fully Softened, Strain-Hardened and Refrigerated Material.** J. G. Hines and T. P. Hoar. *Iron and Steel Institute, Journal,* v. 184, Oct. 1956, p. 166-172.

Plastic strain or subzero treatment applied to fully softened plain 18-8 steel reduced the time to fracture at any particular applied stress and increased the density of cracking. (R1, AY)

**526-R. Growth of External Copper Layers During the Internal Oxidation of Dilute Cu-Al Alloys in a $Cu_2O$-Cu Pack.** D. L. Wood. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1252-1256.

Experimental data suggest that the $Cu_2O$ is vaporized as molecules, which are dissociated at the oxygen-absorbing surface. (R2, J23, Cu, Al)

**527-R. On the Ordering Effects in the Corrosion of $Cu_3Au$ by Aqueous Ferric Chloride.** H. Papazian and Robert A. Lad. *Journal of Metals,* v. 8, sec. 2, *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Oct. 1956, p. 1340.

Some recent results obtained in the study of the rates of corrosion of ordered and disordered polycrystalline $Cu_3Au$. (R5, N10, Cu, Au)

**528-R. Using Stainless Steels for Corrosion Resistance.** Richard Paret. *Machine Design,* v. 28, Oct. 18, 1956, p. 114-121.

Types of stainless steel, types of corrosion, design considerations, fabricating to minimize corrosion, anticipating corrosion during operation. (R general, SS)

**529-R. Hydrazine—for Boiler-Feedwater Treatment.** Eric R. Woodward. *Power,* v. 100, Nov. 1956, p. 80-82.

Treatment with hydrazine reduces scale deposit and corrosion, producing feedwater of slight alkalinity, zero-dissolved solids and complete absence of free oxygen. (R10)

**530-R.** (German.) **Our Contemporary Conceptions of Electrochemical Mechanism of Corrosion. II.** W. Schwarz. *Metall,* v. 10, no. 19-20, Oct. 1956, p. 921-925.

Effect of inhibitors, of materials which decrease the metal ion concentration. Passivity. (R1, R10)

**531-R.** (German.) **Corrosion of Titanium and Its Alloys.** O. Rüdiger, R. W. Fischer and W. Knorr. *Technische Mitteilungen Krupp,* v. 14, no. 4, Sept. 1956, p. 82-87.

Corrosion behavior of titanium. Electrochemical investigation. Corrosion properties of titanium alloys. (R general, Ti)

**532-R.** (German.) **Oxidation of Titanium.** W. Kinna and W. Knorr. *Technische Mitteilungen Krupp,* v. 14, no. 4, Sept. 1956, p. 99-104.

Oxidation behavior at 800, 1000 and 1200° C. (R2, Ti)

**533-R.** (Italian.) **The Problem of Intercrystalline Corrosion of Al-Mg Wrought Alloys.** E. Hugony and M. Monticelli-Papania. *Alluminio,* v. 25, no. 9, Sept. 1956, p. 373-384.

Tests show that the quantity of magnesium must not exceed 4.5%. (R2, Al, Mg)

**534-R.** (Russian.) **The Effect of Molten Lithium, Sodium, and Potassium Nitrates on Nickel, Copper, Duralumin, and Certain Steels.** E. I. Gurovich. *Zhurnal Prikladnoi Khimii,* v. 29, no. 9, Sept. 1956, p. 1358-1365.

Quantitative data on the effect of molten alkali nitrates of certain metals and alloys. The effect manifests itself in two parallel processes: dissolution of the metal and formation of films on its surface. (R6, Ni, Cu, Al, ST)

**535-R.** (Russian.) **Composition of Rust Formed on Iron Contacting Air and Water.** I. V. Krotov. *Zhurnal Fizicheskoi Khimii,* v. 39, no. 8, Aug. 1956, p. 1696-1701.

Up to 149° C. the rust consists of $\gamma$-FeOOH; at higher temperatures it probably is transformed into $\gamma$-$Fe_2O_3$ which terminates at 290° C.; at 676° C. the $\gamma$-$Fe_2O_3$ is entirely transformed into $\alpha$-$Fe_2O_3$. (R3, R4, Fe)

**536-R.** (Russian.) **Electrochemical Protection of Duralumin.** V. V. Gerasimov and I. L. Rozenfeld. *Zhurnal Fizicheskoi Khimii,* v. 30, no. 8, Aug. 1956, p. 1816-1820.

Effect of protective circuit potential on the speed and depth of corrosion penetration. (R10, Al-h)

**537-R. The Protection of Cable Sheathing. The Behaviour of Aluminium Sheathed Cables.** P. A. Raine. *Chemistry & Industry,* 1956, no. 41, Oct. 20, 1956, p. 1102-1111.

Performance criteria, choice of material, behavior in water and soil, protection against corrosion. (R8, R4, R3, Al)

**538-R. The Protection of Cable Sheathing. The Mechanism of Corrosion of Metal Pipes in Soils and Practical Methods of Prevention.** W. W. Robson and A. R. Taylor. *Chemistry & Industry,* 1956, no. 41, Oct. 20, 1956, p. 1111-1119.

Specimens were buried in trenches representing clay, chalk, peat, made-up ground, sandy loam, brackish silt and ashes, and were checked for corrosion in 1, 3 and 10 years. (R8, Pb)

**539-R. Laboratory Method for Corrosion Inhibitor Evaluation.** G. A. Marsh and E. Schaschl. *Corrosion,* v. 12, Nov. 1956, p. 534-538.

A rotating bottle test is described, using as an example the comparison and evaluation of two gasoline rust inhibitors. (R10)

**540-R. A Simple Phase Equilibrium Approach to the Problem of Oil-Ash Corrosion.** W. R. Foster, M. H. Leipold and T. S. Shevlin. *Corrosion,* v. 12, Nov. 1956, p. 539-548.

The diagram resulting from investigation of the compatibility relationships in the system $Na_2O$-$SO_3$-$V_2O_5$ provides a reliable basis for the correlation of previous and current studies of residual fuel-oil ash corrosion. (R7, M24)

**541-R. Potential Criteria for the Cathodic Protection of Lead Cable Sheath.** K. G. Compton. *Corrosion*, v. 12, Nov. 1956, p. 553-560.

Anodic and cathodic polarization curves in representative soils, using a null bridge technique, are given to illustrate the potential changes accompanying corrosion and cathodic protection. (R10, Pb)

**542-R. Structure of Oxide Scales on Nickel-Chromium Steels.** H. J. Yearian, H. E. Boren, Jr., and R. E. Warr. *Corrosion*, v. 12, Nov. 1956, p. 561-568.

Structure of the scales formed on a series of typical steels when oxidized for 100 hr. in air at temperatures from 1600 to 2200° F. were investigated by X-ray diffraction methods. (R2, AY)

**543-R. Corrosion of Metals by Liquid Fertilizer Solutions.** D. C. Vreeland and S. H. Kalin. *Corrosion*, v. 12, Nov. 1956, p. 569-575.

Aluminum, carbon steel, chromium and chromium-nickel stainless steels were tested to evaluate their suitability as constructional materials for storage, transport and applicator tanks for "nitrogen" and "complete-mix" liquid fertilizers. (R6, Al, Cr, ST, SS)

**544-R. Fundamentals of Cathodic Protection, II.** John H. Morgan. *Corrosion, Prevention and Control*, v. 3, Oct. 1956, p. 33-37.

Method of preventing the corrosion of buried or immersed metals; explanation of its mechanism and uses. (R10, Zn, Mg)

**545-R. Two-Step Process Retards White Rust.** L. J. Brown. *Iron Age*, v. 178, Nov. 8, 1956, p. 106-109.

Formation of a relatively stable, water-repellent film on the surface of galvanized steel and a second dip in a chromic-type solution improves protection against water and condensed moisture. (R10, Zn)

**546-R. Structure Dependent Chemical Activity of Polycrystalline Cu$_3$Au—Experiments Relating to the Mechanism of Stress-Corrosion Cracking of Homogeneous Solid Solutions.** Robert Bakish and William D. Robertson. *Journal of Metals*, v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 206, sec. 2, Oct. 1956, p. 1277-1282.

Oxidation of copper by ferric chloride at structural sites was investigated. Copper is selectively removed from the alloy at grain boundaries, incoherent twin boundaries and deformation bands, irrespective of the state of order. (R1, M27, Cu, Au)

**547-R. Selection and Application of Corrosion Inhibitors.** J. D. Crawford. *Producers Monthly*, v. 20, Oct. 1956, p. 22, 24-26.

Inhibitors in oil industry, corrosive oil wells, determining corrosion rates, protection, pellet-type inhibitors, flushing systems. (R10)

**548-R.** (French.) **New Researches on the Initial Oxide Formation in Slow Copper Oxidation.** Finn Gronlund. *Journal de Chimie Physique*, v. 53, no. 7-8, July-Aug. 1956, p. 660-666.

The conditions of initial formation of copper oxide on particular points of metallic surfaces were quantitatively studied in relation to its mechanism. (R2, Cu)

**549-R.** (German.) **On the Cathodic Protection in Soils by the Galvanic Method.** I. T. Markovic. *Werkstoffe und Korrosion*, v. 7, no. 10, Oct. 1956, p. 566-570.

Electrode processes on short circuited electrodes of iron, zinc and magnesium. Degree of saturation of water of the soil. (R10, Fe, Zn, Mg)

**550-R.** (Book.) **Bibliographic Survey of Corrosion, 1952-1953.** 382 p. 1956. National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2, Tex. $12.50.

Compilation of abstracts on all aspects of corrosion. (R general)

# S

# Inspection and Control

**572-S. Acceptance Guides for Ultrasonic Inspection of Large Rotor Forgings.** A. W. Rankin and C. D. Moriarty. *ASME, Transactions*, v. 78, Oct. 1956, p. 1603-1622.

From the results of trepanning and cutting up a number of forgings, guide lines are established for determining when trepanning should be used for identification of the ultrasonic discontinuities. (S13)

**573-S. The Polarographic Determination of Uranium.** H. I. Shalgosky. *Analyst*, v. 81, Sept. 1956, p. 512-518.

Sensitivity of the final method is shown and factors that affect sensitivity discussed. Some experimental work is given in detail. (S11, U)

**574-S. Pipeline Radiography.** Harold Hovland. *British Welding Journal*, v. 3, Sept. 1956, p. 387-391.

Procedures and methods to control weld quality effectively. Qualification tests for radiographers recommended. (S13)

**575-S. A Radiochemical Technique for Determining the Specific Surface Area of Aluminium Metal Surfaces.** John E. Lewis and Robert C. Plumb. *International Journal of Applied Radiation and Isotopes*, v. 1, nos. 1-2, July 1956, p. 33-45 + 2 plates.

Roughness factor of an aluminum surface is determined by radioactive methods after a phosphoric-chromic acid treatment. (S15, Al)

**576-S. Ultrasonic Shear Wave Testing.** W. J. McGonnagle. *Metal Progress*, v. 70, Oct. 1956, p. 97-99.

Ultrasonic flaw detection equipment may be used to inspect difficult-to-reach sections by using shear waves rather than the longitudinal waves normally employed. (S13)

**577-S.** (English.) **Studies on the Determination of Germanium. I. Spectrographic Determination of Germanium in Ores by the Intermittent Arc Method.** Hidehiro Goto and Yu Yokoyama. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 8, no. 3, June 1956, p. 166-172.

Ores were dissolved in nitric acid, germanium was separated by distillation, and, after neutralization, cupric chloride solution was added to the distillate as an internal standard. (S11, Ge)

**578-S.** (English.) **Influence of Arsenic on the Analysis of Iron and Steel. I. The Determination of Sulphur and Phosphorus in Iron and Steel. II. Determination of Copper and Manganese in Iron and Steel.** Hidehiro Goto and Shiro Watanabe. *Science Reports of the Research Institutes, Tohoku University*, ser. A, v. 8, no. 3, June 1956, p. 157-165, 223-229.

Method for avoiding the interference of arsenic was established. There was no direct influence of arsenic in the sodium thiosulphate or hydrogen sulphide separation methods. (S11, Cu, Mg, ST, Fe)

**579-S.** (French.) **Cobalt Analysis Through a High Dispersion Spectrograph in the Visible Field.** Lucien Meunier. Paper from "XXVIII Congreso Internacional de Quimica Industrial". v. I. Saez, p. 595-598.

Description of spectrographic measurement of cobalt impurities such as aluminum, chromium, copper, iron, manganese, lead and zinc. The choice of analytical lines is discussed and the excitation-type spectrum is studied. (S11, Co)

**580-S.** (German.) **Experience With Spectroscopic Determination of Foreign Elements in Pig Iron.** Carl Frick and Karl Friedrich Lauer. *Archiv für das Eisenhüttenwesen*, v. 27, no. 9, Sept. 1956, p. 557-562.

Equipment used, shape and condition of the specimen, test methods and calibration. (S11, CI)

**581-S.** (German.) **Defect Detection by the Method of Ultrasonic-Impulse Time.** Erich Martin and Karl Werner. *Archiv für das Eisenhüttenwesen*, v. 27, no. 9, Sept. 1956, p. 579-594.

Investigation on longitudinally expanded specimens of cross and length defects by means of vertical and transverse oscillations. (S13)

**582-S.** (German.) **Carbon in Nonferrous Metals. V. Carbon in Titanium and Titanium Alloys.** Joseph Fischer and Walter Schmidt. *Zeitschrift für Erzbergbau und Metallhüttenwesen*, v. 9, no. 9, Sept. 1956, p. 434-439.

Potentiometric determination of carbon gives results with an exactness of ± 1.5%. (S11, Ti)

**583-S.** (Russian.) **A Comparison of the Effectiveness of Various Radioactive Isotopes for Testing the Quality of Welded Joints.** A. S. Fal'kevich and I. E. Neifel'd. *Svarochnoe Proizvodstvo*, no. 9, Sept. 1956, p. 23-24.

Relative advantages and disadvantages of using the soft-radiation isotopes, cesium-134, iridium-192, europium-154, and cesium-137, instead of the hard-radiation isotope cobalt-60 for inspection. Recommends the use of cesium-134 and iridium-192, which secure a sensitivity 2 to 3 times higher than cobalt-60. (S13)

**584-S.** (Spanish.) **X-Rays Are Applied to Welded Joints.** *Fusion de Metales*, v. 18, no. 5, Sept.-Oct. 1956, p. 3-5.

Portable X-ray apparatus for the examination of large welds. (S13)

**585-S.** (Swedish.) **Testing Materials With Radioactive Isotopes.** J. E. Holmström. *Hitaustekniikka Svetsteknik*, no. 4, July 1956, p. 111-112.

Testing steel and cast iron with gamma-rays emitted by radioactive isotopes such as cobalt-60, cesium-137, iridium-192, and others. Comparison with X-ray technique. Advantages and disadvantages of isotope technique. (S13)

**586-S. Magnetic Particle and Penetrant Inspection.** R. Bentley. *British*

*Welding Journal*, v. 3, Oct. 1956, p. 494-496.

Method can be used on almost any material, metallic or otherwise, the limitation being that only surface flaws can be detected. Cracks, laps and porosity are clearly shown. (S13)

**587-S. A Conductivity Method for the Accurate Determination of Carbon in Low-Carbon Steels.** D. F. Dailly and T. A. Elliott. *Chemical Society, Journal*, 1956, Sept. 1956, p. 3398-3404.

Apparatus and procedures. (S11, CN)

**588-S. The Aluminum Reduction Method for the Determination of Oxygen in Steel.** J. E. Wells. *Iron and Steel Institute, Journal*, v. 184, Oct. 1956, p. 185-187.

A description of the vacuum method adopted. Results are compared with results of the vacuum-fusion method. (S11, ST)

**589-S. Efficient Instrumentation for Oil or Gas Fired Heat Treatment Furnaces.** L. Walter. *Metal Treatment and Drop Forging*, v. 23, Oct. 1956, p. 420-422.

Various types of furnaces are considered in relation to suitable control instrumentation. Problems of equipment existing and new plants. (S16, J general)

**590-S. Spectrochemical Analysis of Titanium and Titanium Alloys by a Porous Cup-Spark Method.** M. J. Peterson. *U. S. Bureau of Mines, Report of Investigations* 5256, Sept. 1956, 15 p.

Apparatus, preparation of standards and samples, procedure. (S11, Ti)

**591-S. Nondestructive Testing Tips for Non-Ferrous Castings.** Rebecca H. Sparling. *Western Metals*, v. 14, Oct. 1956, p. 63, 65, 67-68.

Reasons for defects, radiographic inspection, fluoroscopy and surface penetrant inspection, defects found by these methods. (S13, EG-a)

**592-S. Acid Open Hearth Products and Their Specifications.** G. R. Fitterer. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 267-276; 289-291.

Specifications for forged and rolled products and for steel castings. The phosphorus and sulphur problem. (S22, D2, ST)

**593-S. Standardization in Relation to Control in Steel Production.** G. Weston and R. L. Richards. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II. United Nations, p. 400-406; 420-421.

An outline of the principles underlying the control of steel types according to national specifications in highly industrialized countries, with special reference to the factors which operate in Great Britain. (S22, ST)

**594-S. The Control of Composition During Steelmaking.** G. Weston and G. R. Bolsover. Paper from "A Study of the Iron and Steel Industry in Latin America". v. II, United Nations, p. 406-409.

Control of raw material supplies and of composition in the melting unit; control after leaving the furnace. (S18, D general, ST)

**595-S.** (French.) **Nitrogen Analysis in Steels by the Wet Process.** J. Calmettes and J. Drain. *Revue de Métallurgie*, v. 53, no. 9, Sept. 1956, p. 682-688.

Uses the absorptiometric analysis of ammonia distilled from etching solutions. (S11, ST)

**596-S.** (French.) **Contribution to the Study of the Determination of Nitrogen in Cast Iron.** J. Marot. *Revue de Métallurgie*, v. 53, no. 9, Sept. 1956, p. 689-700.

Analysis for nitrogen entailed perfecting an apparatus for vacuum smelting in the presence of sodium peroxide, because the Kjeldahl process allowed the gaseous nitrogen to escape. (S11, CI)

**597-S.** (German.) **Contactless Thickness Measurement of Nonferromagnetic Metals.** F. Benz. *VDI Zeitschrift*, v. 98, no. 29, Oct. 1956, p. 1680.

Application of a varying magnetic field for inductive measurement of thickness. The current displacement effect produces a shielding which depends on the thickness of the metal being measured. (S14)

**598-S.** (Russian). **Ultrasonic Detection of Laminations in Sheet Metal.** P. P. Khramov and G. V. Prorokov. *Zavodskaia Laboratoriia*, v. 22, no. 9, Sept. 1956, p. 1065-1068.

An experimental electronic device for inspection of sheet metals. (S13)

**599-S.** (Russian.) **Ultrasonic Signal Reflection Method of Testing Turbine Disks.** B. Ia. Litvinenko. *Zavodskaia Laboratoriia*, v. 22, no. 9, Sept. 1956, p. 1068-1070.

Experimental data on the use of the ultrasonic reflection method for detecting defects. (S13)

**600-S.** (Russian.) **Radioactive Tracer Method of Determining Processing Time of Materials in the Sponge Iron Kiln.** V. F. Kniazev and O. V. Travin. *Zavodskaia Laboratoriia*, v. 22, no. 9, Sept. 1956, p. 1071-1072.

Data on the use of radio calcium-45 for determining processing time in the rotary kiln sponge iron process. (S19, D8, Fe)

**601-S. Etch Penetrant Pinpoints Casting Surface Defects.** G. Tyler. *Iron Age*, v. 178, Nov. 1, 1956, p. 96-97.

New technique developed for inspection on critical aircraft castings; 10-min. test is applied at foundry level. (S13, Mg)

## T
## Applications of Metals in Equipment

**248-T. Processing and Purification of Silicon for Semiconductor Use.** D. K. Hartman and P. L. Ostapkovich. *Metal Progress*, v. 70, Oct. 1956, p. 100-103.

The silicon used in electronic devices must contain less than one part in one hundred million of impurities, and techniques for obtaining such purity have now been developed. (T1, Si)

**249-T. Fabricating Consumable Electrodes of Zirconium, Titanium, and Similar Metals for Arc Melting.** R. A. Beall, F. W. Wood and P. C. Magnusson. *U. S. Bureau of Mines, Report of Investigations* 5247, July 1956, 25 p.

Fabrication of consumable electrodes by sintering, nippling and welding lightly pressed compacts of scrap metal. (T5, C21, Ti, Zr)

**250-T.** (French.) **Heat Properties of Some Nonferrous Products That Are Usable in Aeronautics.** R. Chevigny. *Metaux, Corrosion-Industries*, v. 31, no. 373, Sept. 1956, p. 369-377.

Studies of ordinary aluminum alloys and sintered aluminum and titanium alloys in relation to their use in airplane parts working at average temperatures. (T24, Al, Ti)

**251-T.** (German and French.) **Contact Rails of Sectional Aluminum.** G. Dassetto. *Aluminium Suisse*, v. 6, no. 5, Sept. 1956, p. 161-173.

Use of V or L-sections of aluminum or aluminum alloys for the third rail of electric railways using currents up to 1000 amp. Design and fabrication factors. (T1, T23, Al)

**252-T. Study of 7% and 8% Chromium Creep-Resisting Steels for Use in Steam Power Plant.** M. G. Gemmill, H. Hughes, J. D. Murray, F. B. Pickering and K. W. Andrews. *Iron and Steel Institute, Journal*, v. 184, Oct. 1956, p. 122-144.

Development work on various 7% chromium-base steels of duplex constitution. Metallurgical characteristics of various 8% chromium, 3% molybdenum steels, ferritic at all temperatures. Properties of an 8% chromium - molybdenum - titanium steel. (T25, AY)

**253-T.** (Polish.) **The Application of Cast Iron for Car Wheels.** Kazimierz Hess. *Przeglad Odlewnictwa*, v. 6, no. 9, Sept. 1956, p. 268-278.

Results of tests on over 1000 wheels on mining cars or on cranes. (T23, CI)

**254-T.** (Polish.) **Cast Iron Crankshafts for the Motor Type S42 for the Car Star 20.** Leon Jamroz. *Przeglad Odlewnictwa*, v. 6, no. 9, Sept. 1956, p. 278-286.

Considers design and testing of cast iron crankshafts which in many cases surpass steel in quality. (T21, CI)

**255-T. Armament Metallurgy.** H. P. Tardif. *Canadian Metals*, v. 19, Oct. 1956, p. 42, 44-45.

Guided missile work, high-strength steels, craze cracking in gun tubes, armor and shaped charge research, metallographic observations. (T2)

**256-T. Stainless in Aircraft Design.** Edward A. Loria. *Steel*, v. 139, Nov. 5, 1956, p. 142-143.

Data on several new types of austenitic stainless steels. (T24, SS)

**257-T.** (Hungarian.) **Investigations on the Transition Resistance of Copper and Silver Contacts.** Jozsef Mocsary. *Elektrotechnika*, v. 49, no. 9, Sept. 1956, p. 275-280.

Contact pressure and resistance are related and effects of mechanical vibration are noted. (T1, P15, Ag, Cu)

## V
## Materials
### *General Coverage of Specific Materials*

**208-V. The Heat Treatment, Transformation Reactions, and Mechanical Properties of Some High-Strength Zirconium-Base Alloys.** Herbert A. Robinson, J. Robert Doig, Morris W. Mote and Paul D. Frost. *Battelle Memorial Institute (U. S. Atomic Energy Commission)*, BMI-1125, Aug. 1956, 60 p.

A zirconium-molybdenum-tin alloy was heat treated to 168,500-psi. tensile strength and 153,500-psi. yield strength, with 11.5% elongation in 1 in. Transformations that occurred on aging various alloys are represented by equations. (Sn, Mo, Zr)

**209-V. Structural Stability of Modified 12-Chromium Alloys.** W. C. Hagel and E. F. Becht. *ASME, Transactions,* v. 78, Oct. 1956, p. 1439-1446.

Certain alloys were found to be stable after long-time static aging and service exposure at high temperatures. Effects of precipitating phases on mechanical properties. (Q general, Cr)

**210-V. Gray Iron Castings.** Robert J. Fabian. *Materials & Methods,* v. 44, Oct. 1956, p. 121-136.

Presents the engineer with basic data for intelligent design, in regard to engineering properties, design considerations, heat treatment, finishing and joining, applications. (E general, CI)

**211-V. Materials Engineering File Facts. Cobalt and Cobalt Alloys.** F. R. Morral. *Materials & Methods,* v. 44, Oct. 1956, p. 141.

Materials data sheet includes percentages of composition, physical and mechanical properties, thermal treatment, fabricating properties, corrosion resistance. (Co)

**212-V. Molybdenum: Open for Business.** *Steel,* v. 139, Oct. 22, 1956, p. 80-82.

Development of molybdenum as a high-temperature resisting metal, including present and potential uses. (T general, Mo)

**213-V. Zirconium. A Bibliography of Unclassified Report Literature.** *U. S. Atomic Energy Commission,* TID-3304, July 1956, 43 p.

Contains 225 annotated references to unclassified reports. (Zr)

**214-V. Production of Uranium From Ore to Metal.** Alex Stewart. Paper from "Uranium and the Atomic Industry", no. 11, Atomic Industrial Forum, Inc., p. 31-44.

Various features of uranium and fabrication, processing, and the interrelationships of each phase. (U)

**215-V.** (German.) **Origin of Nonmetallic Impurities in Aluminum, and Their Effect on Further Processing.** H. Schmitt and H. Wittner. *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 9, no. 9, Sept. 1956, p. 417-421.

Origin of aluminum oxide, carbon, phosphorus, sulphur, nitrogen, sodium, potassium and hydrogen. Effect in processing. Problem of blowhole formation. Effect of vacuum treatment. (Al)

**216-V. Past, Present, and Future of High Temperature Nickel Base Alloys.** F. L. VerSnyder. *Journal of Metals,* v. 8, sec. 1, Oct. 1956, p. 1445-1449.

Chemical composition, melting, casting and processing, mechanical properties, alloying and structure, special manufacturing problems. (Ni)

**217-V. Metallurgy of Titanium.** Marion G. Mastin. *Ordnance,* v. 41, Nov.-Dec. 1956, p. 432-435.

Production procedures and problems, reasons for high cost. (Ti)

**218-V. Rem-Cru C-120AV.** *Rem-Cru Titanium Data Sheet,* 1956, Sept. 1956, 11 p.

Alloy design, applications and available standard forms of alloy. Includes physical properties, creep, stability, notch stress rupture, impact, corrosion resistance, forging, annealing, welding and machining. (Ti)

**219-V. Problems Associated With the Production and Use of Wrought Aluminium Alloys.** G. Forrest and K. Gunn. *Royal Aeronautical Society, Journal,* v. 60, Oct. 1956, p. 635-658.

High-temperature treatment at several processing stages is discussed in addition to remelting, alloying, casting, mechanical working and mechanical properties. (Al)

**220-V. Zirconium and Zirconium Alloys.** E. F. Eiswerth. *Steel Horizons, (Technical Horizons),* v. 18, 4th quarter, 1956, 5 p.

Information on present and prospective uses, properties and processing. (Zr)

**221-V.** (German.) **Further Development of Hot Rolled Transformer Sheet Metal.** Alexander Mühlinghaus. *Elektrotechnische Zeitschrift,* v. 77, Ausgabe A, no. 20, Oct. 1956, p. 732-736.

Attempts to develop a hot rolling sheet with higher specifications than that produced by the old, cold rolling method. (SG-p)

**222-V.** (German.) **Technical Ti-6Al-4V Titanium Alloy, Its Properties and Heat Treatment.** W. Knorr. *Technische Mitteilungen Krupp,* v. 14, no. 4, Sept. 1956, p. 88-98.

Raw materials, effect of heat treatment on properties, effect of alloying additions. (Ti)

**223-V.** (Polish.) **High-Yield Strength Silicon Steel. II.** S. Przegalinski. *Prace Instytutow Ministerstwa Hutnictwa,* 1956, no. 3, p. 97-116.

Compositions and mechanical qualities of several steels. (AY)

**224-V.** (Polish. **Thermo-Bi and Trimetals.** F. Legowski. *Prace Instytutow Ministerstwa Hutnictwa,* v. 4, no. 8, 1956, p. 231-236.

Operating principles of thermobimetals. Trimetals contain an intermediate layer for electrical conductance. (SG-a)

**225-V. Magnesium-Thorium Alloy.** *Product Engineering,* v. 27, Nov. 1956, p. 200-204.

A new light alloy with high modulus-to-weight ratio for use in the 500 to 700° F. range. Mechanical properties, heat treatment, forming and welding technique, corrosion treatment. (Mg, Th)

**226-V.** (Russian.) **Heat-Resistant Chromium Stainless Steels for Parts Working at Temperatures from 550 to 560°** C. A. I. Chizhik and E. A. Khein. *Metallovedenie i Obrabotka Metallov,* no. 9, Sept. 1956, p. 10-17.

A report on experimental meltings of heat resistant stainless steels with small amounts of alloying elements intended to secure sufficiently high heat resistant properties together with a practically ferrite-free structure. (SS)

**227-V.** (Book.) **Alcoa Structural Handbook. A Design Manual for Aluminum.** 400 p. 1956. Aluminum Co. of America, Alcoa Bldg., Pittsburgh, Pa.

Characteristics, manufacture and fabrication of aluminum alloy products, design of aluminum alloy strength members, elements of sections, tolerances and commercial sizes of aluminum alloy products, conversion tables and other useful data, specifications. (Al)

**228-V.** (Book.) **Titanium, Zirconium, and Some Other Elements of Growing Industrial Importance.** 123 p. 1956. European Productivity Agency of the Organisation for European Economic Co-Operation, 2, Rue André-Pascal, Paris-16, France. $1.50.

Data on production, refining, fabrication and economic aspects. Includes information on semiconductor elements and on tantalum and other refractory metals. (Ta, Be, Ti, Zr)

**229-V.** (Book—German.) **Cast Steel.** Heinrich Poetter. 368 p. 1955. VEB Verlag Technik, Berlin, Germany.

Handbook for metallurgists and students. Deals with structure, effect of inclusions and alloying elements, effect of gases, mechanical, physical and chemical properties, types of cast steels. (CI)

**230-V.** (Book—Spanish.) **Tungsten as an Alloying Element in Structural Steels.** Pedro Gomez Baeza. 121 p. 1953. Langa Y Cia, Tahona de las Descalzas, 6 Madrid, Spain.

Behavior of tungsten in structural steels, its influence on the transformations, temperability and properties of steels with 0.36% carbon. Studies of manganese-tungsten and aluminum-chromium-tungsten steels. Effect of boron in manganese-chromium-tungsten steels. Practical applications. (AY, W)



# EMPLOYMENT SERVICE BUREAU

**The Employment Service Bureau is operated as a service to members of the American Society for Metals and no charge is made for advertising insertions. The "Positions Wanted" column, however, is restricted to members in good standing of the A.S.M. Ads are limited to 50 words and only one insertion of any one ad. Address answers care of A.S.M., 7301 Euclid Ave., Cleveland 3, O., unless otherwise stated.**

## POSITIONS OPEN

### Midwest

METALLURGIST: Middle-aged man with metallurgical degree and lots of practical experience, to plan the installation and take complete charge of a new complete heat treating plant. Operations will include heat treating, normalizing, annealing, carburizing, etc., of precision machined parts, including gears. Box 12-5.

INSTRUCTOR OR ASSISTANT PROFESSOR: To teach courses in physical metallurgy. Needed for February 1957. Opportunity for graduate study. Salary and rank dependent on qualifications. Apply: Chairman, Department of Mining and Metallurgy, University of Wisconsin, Madison 6, Wis.

RESEARCH METALLURGISTS: Excellent openings in established Detroit laboratory engaged in ferrous and nonferrous metallurgical research. Applicants should be college graduates in metallurgy and must have completed obligation to military service. Research experience an advantage but not a requisite.

RESEARCH METALLOGRAPHER: Responsible position available to metallographer with considerable research experience and reputation in the field. Please furnish full details of education and experience along with expected salary and recent photograph. Apply direct to: Climax Molybdenum Co. of Michigan, 14410 Woodrow Wilson, Detroit 38, Mich.

RESEARCH ENGINEER: With engineering degree, including courses in metallurgy and two years of practical experience in welding. Will fill position in production development laboratory at plant now under construction in Neosho, Mo., scheduled for completion about the first of the year. Company's functions will be manufacture and testing of large liquid propellent rocket engines. Box 12-10.

METALLURGIST OR METALLURGICAL ENGINEER: To manage powder metal parts division. Must have full knowledge in all phases of the industry. Good opportunity for right man, salary commensurate with ability. In reply, state qualifications, experience, etc. Box 12-90.

STAINLESS METALLURGIST: For Technical Service. B.S. degree in metallurgy or equivalent. Five to ten years mill processing, laboratory and customer contact work on stainless steels with emphasis on strip. Should have good appearance and good personality and be willing to travel about half time. Forward complete information including employment history, education, and salary requirement to: R. D. Crissman, Staff Assistant—Employment, Universal-Cyclops Steel Corp., Box 153, Bridgeville, Pa.

METALLURGICAL ENGINEER: With induction melting experience for responsible position in production of vacuum-melted alloys. Excellent opportunity in a young, growing company. Salary open. Moving expenses paid. Write fully and in confidence to: Plant Manager, Cannon-Muskegon Corp., 2875 Lincoln St., Muskegon, Mich.

### East

METALLURGISTS: Opportunities available in both plant production and research and development problems involved in stainless steel manufacturing. B.S. degree in engineering required. Excellent opportunity for young man to establish in large and progressive organization and to work with new grades of stainless steel. Box 12-15.

METALLURGICAL ENGINEER: Fast-growing specialty rolling mill located in New York City suburbs seeks man for key position. Company processes ferrous, nonferrous, clad and nuclear metals. Salary commensurate with applicable experience. Excellent opportunity to put down roots and grow with company. Will be responsible for process, quality control and development. Position is a challenging one and never dull. Box 12-20.

METALLURGICAL ENGINEER: Experienced in steel plant equipment and processes. Report, publication and consulting work, with some traveling. Home office in New York. Write stating background, experience, etc. Box 12-95.

METALLURGIST: Needed in brass mill manufacturing phosphor-bronze, nickel-silver and brass in the form of strip, wire and rod. Excellent position offering advancement and many benefits. Write: The Riverside Metal Co. Division of H. K. Porter Co., Inc., Riverside, N. J.

### West

METALLURGIST: Opportunity to live in San Francisco Bay Area. Metallurgical, nondestructive testing, heat treatment and welding process work in large electrical manufacturing plant producing steam turbines, atomic power equipment, large rotating machinery, transformers, motors, etc. Position is in metallurgical engineering laboratory. Reply to: Employment Supervisor, Westinghouse Electric Corp., Sunnyvale, Calif.

## POSITIONS WANTED

METALLURGICAL ENGINEER: B. S. degree, extrusion development and production supervision, nonferrous background in casting, rod and wire, strip, tube, hot rolling, alloy development, customer contacts, trouble shooting and laboratory supervision. Box 12-25.

ADMINISTRATIVE CORROSION ENGINEER: Good progress record covering laboratory evaluation, technical reporting, sales-service, manager phosphate coating chemical manufacturing plant. Presently supervisor surface treatment/corrosion laboratory covering protective systems for missiles. Interested in position challenging ability and long-term connection. Resume upon request. Box 12-30.

PROCESS METALLURGIST: B.S. degree, age 30, two children. Five years experience in development, process control, sales, testing, heat treating. One year in sales and development of wear resistant treatment. Laboratory supervisor, cold finishing mill experience. Desires responsible position in materials and process engineering involving industrial product development. Prefers East Coast. Box 12-35.

NONDESTRUCTIVE TESTING TECHNICIAN: Thirty years X-ray experience, certified by A.A.F., certified magnaflux operator and inspector, material analyst for large plant. Five and one-half years college, eight years teaching "Strength of Materials" in evening school. Married, age 61, top physical condition. Box 12-40.

METALLURGICAL ENGINEER: B.S. degree, age 40, family. Thirteen years diversified experience in aircraft and mining and construction industry. Experience includes specifications, processing and X-ray of ferrous and nonferrous materials, development work, failure analysis, quality control. Desires position in development or production. Prefers New England or the West. Box 12-45.

METALLURGIST: B.S. degree, age 43. Twenty years experience with steel and oil companies, production, development and maintenance, including heat treating, forging, welding, foundry and corrosion. Consultant to purchasing and design departments, vendor contact in U.S., Europe and Far East. Prefers position as plant metallurgist. Box 12-50.

METALLURGIST: Age 38, married, family. B.S. in chemical engineering, Notre Dame, 1940. Sixteen years experience in foundry, automotive parts, electrical components and powdered metallurgy. Desires position in process or production control in Midwest. Box 12-55.

RESEARCH AND DEVELOPMENT METALLURGIST: Ph.D. degree, age 33, married, veteran. Six years experience in performance and supervision of research and development on gas turbine materials and joining processes, electron metallography and elevated temperature unlubricated wear. Three years graduate teaching experience. Publications, patents. Desires position of greater responsibility. Salary from $15,000. Box 12-60.

METALLURGICAL ENGINEER: Age 36, nine years experience in alloy development, metallurgical investigation, laboratory supervision, and customer service work, desires technical position in engineering or sales with progressive organization. Box 12-100.

METALLURGICAL ENGINEER: With 15 years experience in ferrous and powdered metallurgy in automotive and aircraft industry. Seeks technical position as metallurgist or sales engineer. Desires to be located in Florida or vicinity. Married, two children, age 40. Wants permanent position with growing concern. Box 12-105.

Graham Laboratory, Jones & Laughlin's modern research center in Pittsburgh, Pa.

# RESEARCH METALLURGISTS

Several attractive openings are available for metallurgists, with graduate level training or equivalent research experience, to participate in expanding research and development programs in PROCESS, PRODUCT, AND PHYSICAL METALLURGY.

Work will be carried out in our modern laboratories in suburban Pittsburgh. Excellent opportunities are available for professional advancement in a young and growing organization.

Send resume, in confidence, to:

J. A. Hill
Research and Development Department
**JONES & LAUGHLIN STEEL CORPORATION**
3 Gateway Center
Pittsburgh 30, Pennsylvania

J&L STEEL

## SALESMEN—

## DISTRICT SALES MANAGERS

Leading manufacturer of investment castings has several openings for aggressive sales engineers and two district sales managers. Experience in foundry practices essential. Excellent opportunities and income potential for technically qualified sales personnel. Company benefits and incentive plan. Salary and commission.

Box 12-85, Metals Review

# METALLURGIST

To conduct development programs aimed at establishing design and manufacturing criteria for the application of metals of all types to ramjet engines. Programs will cover variety of structural materials and many manufacturing processes including such diversified fields as:

1. The evaluation of new alloys from aluminum to molybdenum.
2. The development and evaluation of new manufacturing techniques from welding and forming to the application of ceramic coatings and high temperature brazing.
3. Investigations of the physical and mechanical properties of materials at temperatures from $-350$ F° to $+3000$ F° for service lives ranging from seconds to hours.
4. Support of the design and fabrication of experimental ramjet engines.

Bachelors or advanced degrees in physical metallurgy or welding metallurgy are required. Experience in fabrication of light type structures desirable.

Opportunities for advancement exist in a growing concern with a long range future in the propulsion field. Working conditions in this medium size, progressive engineering research and development organization are excellent. Its location in the San Fernando Valley of California assures excellent living and working conditions.

Write or phone collect today.

**Jim Dale**

**MARQUARDT AIRCRAFT CO.**
16555 Saticoy Street
Van Nuys, California
Telephone: STate 7-2811

**Metallurgist** — Development, consulting, and trouble-shooting on metallurgical problems associated with manufacture of airborne military electronic equipment. Experience in magnetic materials and heat treatments desirable. Salary commensurate with experience and ability. For a confidential interview send a resume of your education and experience to:

**Dr. J. A. Medwin**
**Dept. 538**
**Westinghouse Electric Corporation**
**P. O. Box 746**
**Baltimore 3, Maryland**

## DEVELOPMENT METALLURGIST

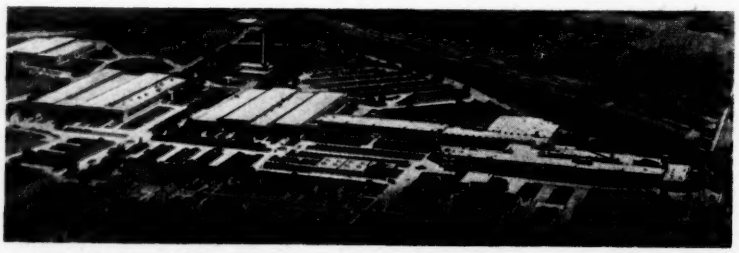
**For alloy development projects in the production of cast iron and cast or wrought nonferrous products. Engineering degree and five or more years practical experience with operating equipment and processes. Capable to conduct systematic and constructive metallurgical investigations in melting, alloying and casting. Fine opportunity for seriously interested young metallurgist to gain valuable experience and to qualify for future promotion in progressive, nationally known corporation. Confidential.**

**Box 12-65, Metals Review**

## SPECIAL BULLETIN:

### ENGINEERS AND SCIENTISTS

Battelle Institute, one of the world's leading independent research organizations, has just published a new booklet describing the varied and unusual career opportunities in its laboratories. Write today for your copy, without obligation, to the Personnel Manager, Battelle Institute, Columbus 1, Ohio.



Air View of Metals & Controls Corporation Plant at Attleboro, Massachusetts

# WE'RE EXCITED about our Future...

. . . and you would be, too, if you were a member of the nation's first privately-owned producer of Fuel Elements for Atomic Reactors. What really makes us excited, however, is the projection of our business into the future. We are already adding on to our brand new 43,000 square foot building just to fill orders already on the books. However, if we are to continue to make history in this expanding industry, we will need competent, energetic and experienced men to do both development and process engineering work. If you have some background in metals fabrication and are challenged by technical problems in this area, we would like to talk with you.

Technical people joining us will work in a stimulating atmosphere . . . will assume positions of real responsibility where initiative and ingenuity are essential . . . will be working with the best laboratory and production equipment, and will be working in a small division of a Company of 2500 employees—large enough to have stability, but small enough to retain flexibility. The new employee will be eligible for our Bonus, Profit Sharing, Pension Plans and other benefits . . . will live and work in a pleasant New England city close to the educational and cultural facilities of both Boston and Providence.

Mr. R. A. Beers, our Technical Employment Director, will look forward to hearing from you. Personal interviews through the country can be arranged.

## METALS & CONTROLS CORPORATION

NUCLEAR PRODUCTS DIVISION

34 FOREST STREET **ATTLEBORO, MASSACHUSETTS** ATTLEBORO 1—2800

## TEST ENGINEER

Mechanical or Metallurgical Engineer 5 years experience in Mechanical Metallurgy and Mechanical testing of metals to establish testing methods to quality audit control of Titanium Products. Trouble shoot internal and customer testing problems. Supervise Quality Control physical testing group. New expanding industry with bright future. Liberal benefits and salary commensurate with experience. Send resume to H. W. Barnes, Rem-Cru Titanium, Inc., Midland, Pennsylvania.

## SENIOR METALLURGIST

Preferably with M. S. or Ph. D., with extensive background in the research and development of metallurgical processes in the area of fabrication of metallic structures.

Experience in the following specific areas is desirable:

**Welding**
**Cladding**
**Powder Metallurgy or**
**Arc Melting**

Supervisory and non-supervisory positions are open.

Please send complete resume in confidence to:

**Mr. Richard E. Clarke,**
**Atomic Energy Division**

All inquiries will be answered within 2 weeks.

SYLVANIA

SYLVANIA ELECTRIC PRODUCTS INC

**Box 59, Bayside, L. I., N. Y.**

*is this job for you?*

## METALLURGICAL ENGINEER
(Technical)
## NEEDED

**REQUIREMENTS**

Ph.D., M.S., or B.S. degree and minimum of four years' experience.

**JOB DESCRIPTION**

In development and production departments: Applied non-ferrous (uranium and alloy metals) metallurgy involving reduction, casting, and fabrication of metals... investigation of hot forming methods and metallography studies of metal quality.

**OPPORTUNITY**

Here's your chance to get in on the "ground floor" of a fast-moving new industry... with a company that will be a vital force in atomic age developments. The position will provide you with broad opportunity for utilizing your ability to think and to advance.

Technical Personnel Office
URANIUM DIVISION
**MALLINCKRODT CHEMICAL WORKS**
65 Destrehan St. St. Louis 7, Mo.

---

*careers in peaceful applications of atomic energy*

## METALLURGIST

BS, MS, or Phd with training or experience in physical metallurgy of nuclear fuel materials; in metallography of both fuel and construction materials; in high temperature material (both alloy and ceramet) development and evaluation; in vacuum melting and casting techniques; or in mechanical fabrication related to fuel element manufacture.

Write today. Action will be prompt, confidential

**ATOMICS INTERNATIONAL**
A DIVISION OF NORTH AMERICAN AVIATION, INC.

Mr. G. W. Newton, Personnel Office, Dept. CON
21600 Vanowen St., Canoga Park, California
(In Suburban San Fernando Valley, Los Angeles)

---

## CLEVELAND OPPORTUNITIES FOR MECHANICAL ENGINEERS

If you have had professional experience and want to take advantage of increasing opportunities for professional advancement—SEE US:

- **Research**
- **Development**
- **Design**

in

**Bearing and Friction Materials**

Conduct studies to expand knowledge of frictional and wear properties of lubricated and unlubricated bearings, washers and seals with emphasis on high speed, high temperature applications.

Please write: E. A. Gentry, Personnel Manager

**CLEVITE RESEARCH CENTER**
**540 East 105th Street**
**Cleveland 8, Ohio**

The Clevite Research Center develops new principles and new products for other units of Clevite Corporation. It is a young organization where good work is quickly recognized. Your professional growth will be accelerated by your association with people from other fields such as physics, electronics and chemistry.

---

Attractive opportunity offered to

## METALLURGISTS

in the fields of

**MECHANICAL METALLURGY**
**MATERIALS INVESTIGATION**
**FERROUS AND NON-FERROUS**

Both experienced and trainee applications will be considered

Contact:

Employment Department B140
827 Lapham Street
El Segundo, California

**DOUGLAS**

**DOUGLAS AIRCRAFT COMPANY, INC.**
**El Segundo, California**

## INSTITUTE FOR THE STUDY OF METALS
## UNIVERSITY OF CHICAGO

POSITION OPEN:

Metallurgist in charge of Metallurgical Section to supervise preparation of wide variety of special metals, alloys and other materials for research work.

B.S. in Metallurgy or equivalent experience in metallurgical research or development work. Familiar with metal working, testing and melting equipment. Experience with vacuum and high-purity techniques valuable.

Staff position with liberal employee benefits including one month vacation, pension, insurance, etc. Salary open to negotiation. Interview expenses to qualified candidates.

Telephone or write:

**C. S. Mokstad**
**C. S. Smith**
**C. S. Barrett**

**Midway 3-0800, 5640 S. Ellis Ave., Chicago, Ill.**

## METALLURGISTS

Opportunities available in both plant production and research and development problems involved in stainless steel manufacturing in eastern section. B.S. degree in engineering required. Excellent opportunity for young man to establish in large and progressive organization and to work with new grades of stainless steel.

Box 12-80, Metals Review

**Foundry Metallurgist**

23-32. Opportunity to grow with expanding investment casting company. Metallurgist or engineer with metallurgical experience to develop gating & to maintain quality of aircraft castings. Foundry experience or experience with X-Ray, Zyglo & high temperature alloys desirable. Attractive salary & benefit program.

**Austenal, Inc.**
**Roy St. & Rockaway Rd., Dover, N.J.**

## METALLURGISTS

Activities related to product control. Forge Shop and Heat Treat duties working with Titanium and High Temperature Alloys. Excellent opportunity for advancement. Good starting salary plus employee benefits. The Steel Improvement & Forge Co., 970 East 64th St., Cleveland 3, Ohio.

TRANSLATER (technical)
and ABSTRACTOR

For Research Department of large steel company. Thorough knowledge of German and French required, some understanding of other languages desirable. Scientific education and some practical experience in engineering — metallurgical, chemical, or mechanical—are essential. Please send resume, stating salary desired, to
Box No. 12-70, Metals Review.

**Western Metal Congress**
**and Exposition**
*Pan-Pacific Auditorium*
**Los Angeles**
**Mar. 25-29, 1957**

# Chromium

is well known as an alloy lending hardness and corrosion resistance to steels. High chromium alloys, like hard chromium plate, tend toward brittleness.

# DUCTILE Chromium

is, however, quite possible. The entire matter is explored in this book, sponsored by U.S. Army Ordnance, and written by 45 investigators.

**To be published early in 1957 at $7.50**

**American Society for Metals**
**7301 Euclid Ave.**
**Cleveland 3, Ohio**

## HERE'S HOW . . .

***To get copies of articles annotated in the A.S.M. Review of Current Metal Literature***

## Two alternative methods are:

**1. Write to the original source of the article asking for tear sheets, a reprint or a copy of the issue in which it appeared. A list of addresses of the periodicals annotated is available on request.**

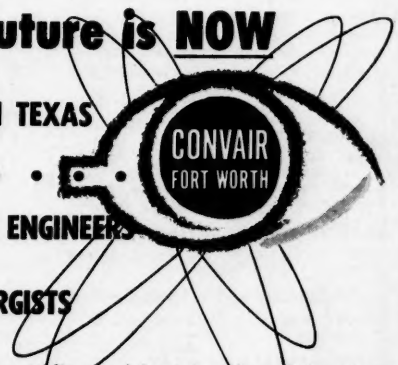
**2. Order photostatic copies from the New York Public Library, New York City, from the Carnegie Library of Pittsburgh, 4400 Forbes St., Pittsburgh 13, Pa., or from the Engineering Societies Library, 29 West 39th St., New York 18, N. Y. A nominal charge is made, varying with the length of the article and page size of the periodical.**

**Write to Metals Review for free copy of the address list**

# METALS REVIEW

**7301 Euclid Avenue** **Cleveland 3, Ohio**

## your future is NOW




**WORK IN TEXAS**

- **WELDING ENGINEERS**
- **METALLURGISTS**

Openings in welding and heat treating of ferrous and non-ferrous metals. Work involves development of metallurgical processes and solution of production problems.
Graduate metallurgists and mechanical engineers without experience will be considered.
Also non-graduates with sufficient experience.
Enjoy liberal benefits including joint company-employee group insurance plan and retirement plan, plus salary commensurate with education and experience. And all this with a Division of General Dynamics Corporation — second to none in the aircraft industry.

*Send Resume of Training and Experience to*
**B. R. TOUDOUZE**

**CONVAIR**
**FORT WORTH**
FORT WORTH, TEXAS
A Division of General Dynamics Corporation


**March 25 through 29, 1957**

Titanium—a comer among metals—versatile—possessing many highly desirable qualities, yet costly and temperamental—presents unique opportunities and challenging problems. The high demand for titanium and its alloys in many forms is impressive—promises increased growth as production techniques improve and costs are reduced.

### A CHALLENGE AND REWARD FOR MEN WHO KNOW

To meet the unique problems of titanium production and processing calls for a high degree of understanding of mechanical working, yield characteristics, and ductility, as well as the effects of alloying and heat treatment on the metal's behavior. Though many fabrication techniques may already be known, there's still much to learn. Something new is always ahead, so plan to attend the Titanium Conference and UPDATE YOUR THINKING!

### THE LATEST AUTHORITATIVE INFORMATION QUICKLY AND AT LOW COST

To men who aspire to achieve in a new and promising field, the American Society for Metals, through its newly created Metals Engineering Institute, is conducting a five-day TITANIUM CONFERENCE in Los Angeles, March 25 through March 29, 1957. Top authorities will lecture, discuss, and instruct. It's an opportunity to get the latest information in minimum time—and at a cost of only $125.00 for the entire course (including daily lunches and study materials).

Since registration is necessarily limited, DON'T DELAY. Enroll now or send for full information AT ONCE. Mail in the accompanying coupon TODAY.

### SUBJECTS TREATED BY TOP AUTHORITIES

**From comprehensive lectures and discussions on the latest known techniques, you can gain a wealth of practical knowledge that is so greatly needed today. The following subjects make this a great course on TITANIUM—short, intensive, and of real value.**

- **CURRENT STATUS**
  Sponge Production Techniques — Guarding against Contamination — Uses of Titanium in Airframes, Missiles, and Jet Engines — Economic Aspects
- **CASTING AND ALLOYING**
  Vacuum Melting—Effect of Alloying Elements —Present and Future Alloys
- **MECHANICAL METALLURGY**
  Strength — Ductility — Yield Properties — Effects of Temperature and Strain Rate
- **FUNDAMENTALS OF HEAT TREATMENT**
  Open Air Treatment—Vacuum Heat Treating—Embrittlement — Degassing — Annealing — Stress Relief — Equilibria — Kinetics — TTT Curves — Metallography
- **MACHINING AND GRINDING**
  Titanium's Affinity for Other Materials and Possible Machining Difficulties—How to Overcome Them—Machines and Tools Involved—Effects of Alloying on Machinability — Chem-milling
- **CORROSION RESISTANCE**
  Principles and Applications
- **WELDING**
  Welding Characteristics — Problems and Techniques
- **FABRICATION PROBLEMS**
  Hot and Cold Fabrication—Steps and Processes—Economic Factors
- **DESIGNING WITH TITANIUM**
  Uses of Formed Sheet — Forgings — Limitations of Castings — Honeycombed Structures — Powder Metallurgy Products

**TITANIUM CONFERENCE** March 25-29, 1957

**Metals Engineering Institute, Dept. MP**
**7301 Euclid Ave.**
**Cleveland, Ohio**

Gentlemen:

☐ Enroll me; $125.00 registration fee enclosed

☐ Send me more information

Name _____

Company Affiliation _____

Address _____

City _____ State _____

# METALLURGISTS

Ph.D. or M.S. scientists for basic research in high temperature materials; magnetic materials; plasticity; mechanism of fracture; effect of alloys and impurities.

For further details, write to:

**M. C. Rohm**
**Employment Section**
**Allis-Chalmers Mfg. Co.**
**Milwaukee 1, Wisconsin**

*is this job for you?*

## METALLURGICAL ENGINEER
(Technical)
## NEEDED

**REQUIREMENTS**

**Ph.D., M.S., or B.S. degree and minimum of four years' experience.**

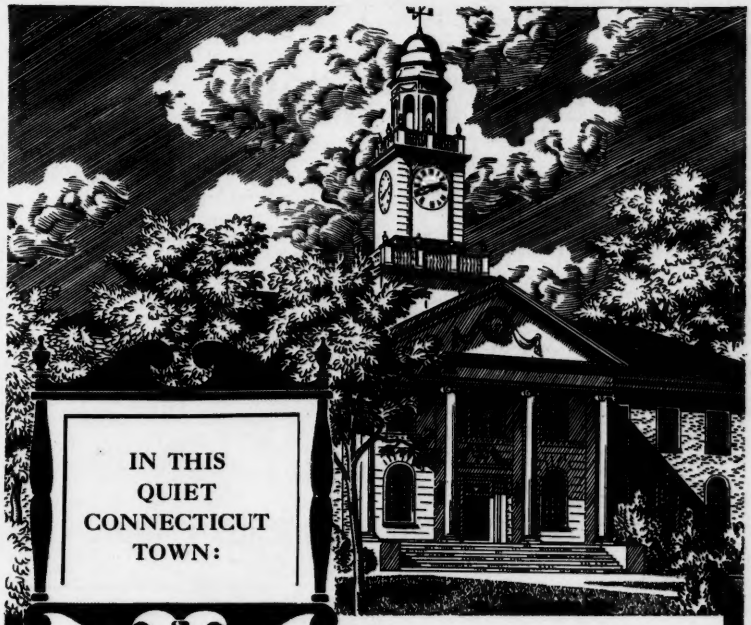
**JOB DESCRIPTION**

**In development and production departments: Applied non-ferrous (uranium and alloy metals) metallurgy involving reduction, casting, and fabrication of metals... investigation of hot forming methods and metallography studies of metal quality.**

**OPPORTUNITY**

**Here's your chance to get in on the "ground floor" of a fast-moving new industry... with a company that will be a vital force in atomic age developments. The position will provide you with broad opportunity for utilizing your ability to think and to advance.**

**Technical Personnel Office**
**URANIUM DIVISION**
**MALLINCKRODT CHEMICAL WORKS**
**65 Destrehan St. St. Louis 7, Mo.**




# A New Adventure for Metallurgists

In peaceful Stratford, Connecticut, America's most diversified engine builder is on a growing spree . . . dwarfing even its own ten-fold engineering growth in the past 7 years. Today, engineers and metallurgists who join Avco Lycoming become part of a great engineering tradition which has, for half a century, originated many of America's most advanced reciprocating and turbine engines for aviation, industry, and defense. World-renowned scientists work closely with all Avco Lycoming engineers and metallurgists on a shirt-sleeve, first-name basis. Just one reason why turnover is almost unknown at Avco Lycoming.

Near Long Island Sound beaches, tree-shaded Stratford boasts schools with excellent pupil-teacher ratios, Shakespearean Festival Theatre, attractive homes, nearness to New York and Boston. Here, engineers, metallurgists and their families find a new measure of enjoyment.

Would you be happy in an advantageous location? Doing meaningful, rewarding work in a company that is not the biggest, but quite possibly the best, in its field? You'll find a metallurgical engineering opportunity now, with Avco Lycoming, at Stratford, Conn., or Williamsport, Pa.

### METALLURGISTS

1. With experience in metallographic examination (no preparation) of ferrous and non-ferrous alloys, control of incoming material, investigation of material problems, and report writing.
2. With experience in ferrous metallurgy to comprise a new group engaged in:
   - **(a)** Failure analysis and investigation of manufacturing problems on reciprocating and gas-turbine aircraft engines.
   - **(b)** Special metallurgical investigation required in the development of engine components, accessories and new product.

**. . . and numerous other engineering opportunities.**

**Write:** Fred Kuder, Technical Division, Room 423M.

**avco Lycoming**

# STAFF POSITION

## *in* ALLOY DEVELOPMENT
## *and* METAL PROCESSING

**EXCELLENT OPPORTUNITY FOR GROWTH IN STIMULATING AND DIVERSE APPLIED RESEARCH**

***SALARY COMMENSURATE WITH EXPERIENCE***

***WRITE TO:*** **RUSSELL S. DRUM**
**TECHNICAL DEPARTMENT H**

**BATTELLE INSTITUTE, COLUMBUS 1, OHIO**

## HORIZONS . . .

has open supervisory research positions in expanding diversified Metallurgy Department in the fields of physical metallurgy, mechanical metallurgy, physical chemistry, precision casting and powder metallurgy. Unusual opportunities for individual diversification, intellectual advancement and personal stimulation. Please apply to:

**HORIZONS INCORPORATED**
**2905 East 79th St.**
**Cleveland 4, Ohio**

## DRAKE PERSONNEL

**National Placement Center for**

**EXECUTIVE, TECHNICAL AND SALES PERSONNEL**

**Specialist in placement and procurement work in the metal trades field.**

**Technicians to Top Executives**

***Please outline briefly your experience on personnel needs to.***

**John Cope**
**220 S. State St., Chicago 4, Ill.**
**HArrison 7-8600**

## METALLURGISTS
## and
## METALLURGICAL ENGINEERS

Opportunities exist for both recent graduates and those with several years' experience in research, development, failure analysis, heat treating, corrosion testing, metallography, welding and general applications of metallurgy. Fully equipped, modern laboratory in Southern Ohio. Send reply with resume and salary information to:

EMPLOYMENT DEPARTMENT

**GOODYEAR ATOMIC CORPORATION**
P.O. Box 628
Portsmouth, Ohio

## SENIOR RESEARCH METALLURGISTS

Research Division of major metal producer in eastern United States has challenging opportunities for two men—one in physical metallurgy, one in process metallurgy—capable of leadership and assuming responsibility for initiation and direction of research projects. Salary to $12,000/yr.

Ph.D. in Metallurgy and at least two years industrial research experience required.

These openings, created by expansion of research activity and facilities, involve both basic and applied research. Program is entirely company - sponsored. Publication of research results is encouraged.

Reply should include detailed resume of academic and technical accomplishments and salary requirements. All replies held in strictest confidence.

**Send response to:**
**Box No. 12-75, Metals Review**

## BRIDGEPORT BRASS

### We Want

2 Research Metallurgists with M.S. degrees or equivalent experience plus five years experience, for research and development work on copper and aluminum-base alloys. Some experience with these metals is desirable. Location: Bridgeport, Connecticut.

1 Mechanical Metallurgist with Met. E. or M.E. degree and approximately five years experience, for testing and metal fabrication problems at our Bridgeport laboratories.

Recent Met. E. graduates for training and assignment in Process Metallurgy, Research, and Development, at Bridgeport, Indianapolis, Indiana, and Adrian, Mich.

### WE Offer

Permanent positions with growing technical organization of an established, expanding, nonferrous producer.

Assistance for graduate studies.

Excellent working conditions in up-to-date labs and plants.

Convenience to uncrowded, pleasant residential areas.

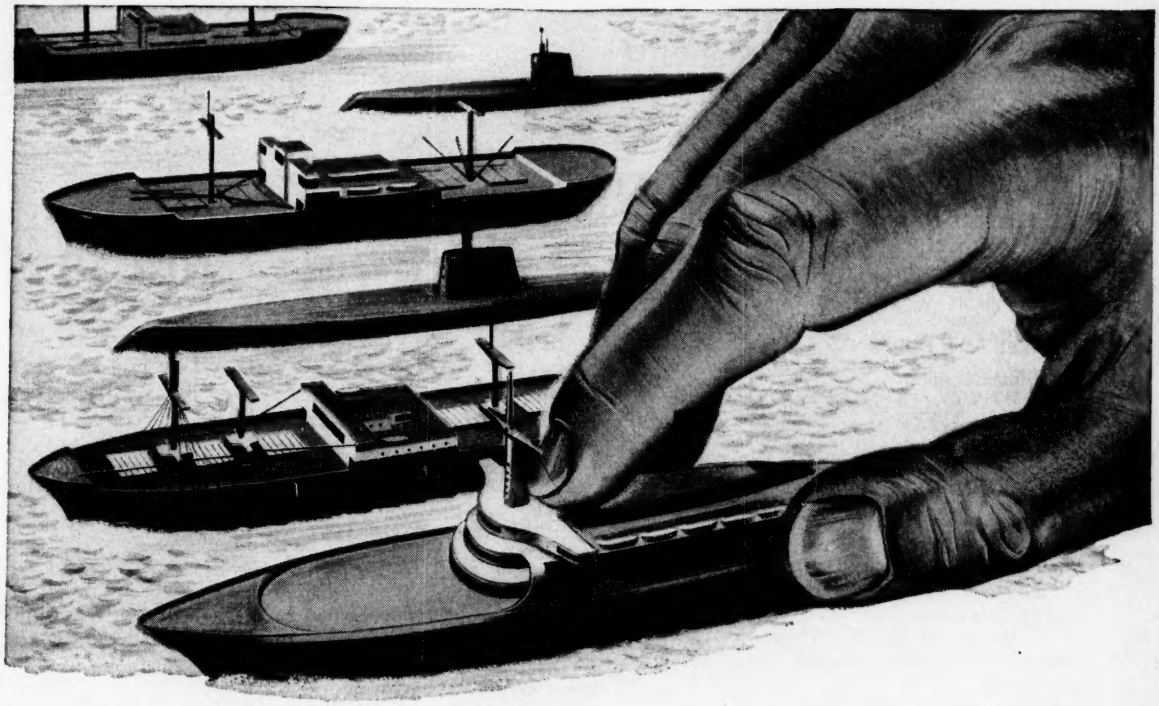
Opportunities for advancement in responsibilities and professional status.

Liberal benefits for you and your family.

For further information about these and other opportunities please contact:

**Mr. T. M. Thompson**
**BRIDGEPORT BRASS CO.**
**30 Grand Street**
**Bridgeport 2, Connecticut**

# METALLURGISTS...



## Help develop the world's first nuclear powered fleet

Nuclear power offers tremendous advantage for naval vessels. From the fuel standpoint, cruising ranges are virtually unlimited—even at new high speeds. No refueling facilities will be required to replenish nuclear propulsion fuel. Therefore, the physical design of the fleet can be streamlined for greater efficiency and safety.

At the country's largest design-engineering center for nuclear power reactors, Bettis Plant in Pittsburgh, operated for the Atomic Energy Commission by Westinghouse, the application of nuclear power has progressed rapidly. However, the nuclear power plants already in operation today represent only the beginning of a new technological era. *Major advances in many areas are necessary.*

These include: the development of fuel alloys; the development of clad alloys; fuel element development; and technical control of fuel elements and fuel and clad alloys. At Bettis you will have a choice of working in either Basic or Applied Metallurgy. You may prefer to conduct basic research in areas like these: 1) Solid phase transformation, 2) Corrosion kinetics and mechanisms, 3) Effect of irradiation on metals, 4) Internal friction studies, 5) Study of equilibrium diagrams.

To do this, Bettis Plant needs farsighted men. Regardless of your interest, you can choose a place in the varied operations at Bettis Plant.

Atomic experience is not necessary.

What's more, Bettis Plant is in Pittsburgh's South Hills. Here you can enjoy good living in pleasant suburbs near the plant, and still be convenient to one of the nation's most progressive metropolitan areas.

Educational opportunities are exceptional. Westinghouse helps you continue your studies at any one of three Pittsburgh universities.

**Write for descriptive brochure on opportunities in your field. Be sure to specify your interests. Address Mr. A. M. Johnston, Westinghouse Bettis Plant, Dept. A97, P. O. Box 1468, Pittsburgh 30, Pa.**


**BETTIS PLANT**

**Westinghouse**

....*A Notable Coincidence*

# *The Second* World Metallurgical Congress

## Entries Will Be Expected From All Over the World– –Display Your Best Work

### RULES FOR ENTRANTS

Exhibitors do not need to be members of the American Society for Metals.

Work which has appeared in previous metallographic exhibits held by the American Society for Metals is unacceptable.

Photographic prints should be mounted on stiff cardboard; maximum dimensions 14 by 18 in. (35 by 45 cm.). Heavy, solid frames are unacceptable.

Entries should carry a label on the *face* of the mount giving:

Classification of entry.

Material, etchant, magnification.

Any special information as desired.

The name, company affiliation and postal address of the exhibitor shou'd be placed on the back of the mount.

Entrants living outside the U. S. A. should send their micros by first-class letter mail endorsed "Photo for Exhibition—May be Opened for Customs Inspection".

Exhibits must be delivered before Oct. 15, 1957, either by prepaid express, registered parcel post or first-class letter mail, addressed:

**Metallographic Exhibit**
**American Society for Metals**
**7301 Euclid Ave.**
**Cleveland 3, Ohio, U.S.A.**

### CLASSIFICATION OF MICROS

*(Optical and Electron)*

Class 1. Irons and steels.
Class 2. Stainless steels and heat resisting alloys.
Class 3. Aluminum, magnesium, beryllium, titanium and their alloys.
Class 4. Copper, nickel, zinc, lead and their alloys.
Class 5. Uranium, plutonium, thorium, zirconium and reactor fuel and control elements.
Class 6. Metals and alloys not otherwise classified.
Class 7. Series showing transitions or changes during processing.
Class 8. Welds and other joining methods.
Class 9. Surface coatings and surface phenomena.
Class 10. Results by unconventional techniques (other than electron micrographs).
Class 11. Slags, inclusions, refractories, cermets and aggregates.
Class 12. Color prints in any of the above classes. (No transparencies accepted.)

### AWARDS AND OTHER INFORMATION

A committee of judges will be appointed by the Metal Congress management which will award a First Prize (a medal and blue ribbon) to the best in each classification. Honorable Mentions will also be awarded (with appropriate medals) to other photographs which, in the opinion of the judges, closely approach the winner in excellence. A Grand Prize, in the form of an engrossed certificate and a money award of $100, will also be awarded the exhibitor whose work is judged best in the show, and his exhibit shall become the property of the American Society for Metals for preservation and display in the Society's national headquarters in Cleveland.

All photographs may be retained by the Society for one year and placed in a traveling exhibit to the various Chapters. They will be returned to the owners in May 1958 if so desired.

# *The Twelfth* Metallographic Exhibit

## Chicago, Illinois, November 2 to 8, 1957


# CHALLENGING CAREER OPPORTUNITIES IN THE URANIUM PROCESSING INDUSTRY

Would you like to get in on the ground floor of an exciting phase of atomic age developments?

The Uranium Division of Mallinckrodt Chemical Works can offer you that opportunity.

A pioneer of the atomic age, Mallinckrodt developed the process for large-scale purification of crude uranium ore for the Manhattan Project in 1942.

Mallinckrodt has continued to serve the nation in this field at its St. Louis plant.

Early in 1957, Mallinckrodt will be operating for the AEC a new plant expansion in excess of $40,000,000 on a 200-acre site at Weldon Spring, Missouri... 27 miles west of St. Louis. These facilities are for converting high-grade uranium ore and concentrates into highly purified uranium compounds or metal.

There are many responsible positions open for skilled, resourceful, technically trained people at the Weldon Spring plant. Opportunities are available in production, engineering, chemical pilot plant, analytical laboratory, instrumentation, laboratory development and metallurgy.

If you have a B.S., M.S., or Ph.D. in the fields of...

INORGANIC CHEMISTRY—CHEMICAL ENGINEERING—METALLURGICAL ENGINEERING

SEND A RÉSUMÉ TO: TECHNICAL PERSONNEL OFFICE
URANIUM DIVISION
MALLINCKRODT CHEMICAL WORKS
65 DESTREHAN ST. • ST. LOUIS 7, MO.

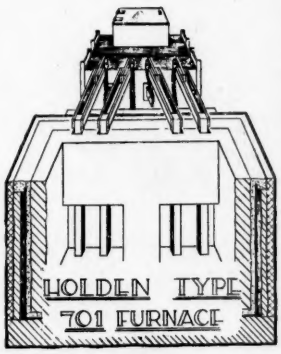
Mallinckrodt

HOLDEN
METALLURGICAL PRODUCTS
TRADE MARK REGISTERED

# are MONEY MAK-ERS for INDUSTRY

## JOIN THE PARADE

## HOLDEN Salt Baths = QUALITY CONTROL




ADDITIVES REPLACE.....
1. Carbon Rods
2. Rectifiers
3. Gas Rectifiers

DOWN TIME..... How much per day?

## DOWN TIME WITH ADDITIVES.....NONE!

## How YOU can change to HOLDEN Salt Baths with Additives–

1. Send 1 lb. sample of salt in furnace.
2. Send 1 lb. sample of salt as purchased.

## We will furnish (FREE) correct additives with original purchase order.

**Purchase and add HOLDEN SALT BATH QUALITY CHEMISTRY to your production operations.**

## FREE Holden Literature: (NEW)

#200—Holden Salt Baths
#201—Holden Pot Furnaces
#203—Rubber Mold Cleaning, Paint Removal, Descaling & Desanding
#204—Pressure Nitriding
#205—Industrial Furnaces
#206—Austempering-Martempering
#207—NEW—Recirculation Radivection Furnace . . . 300° to 1750° F.

# THE A. F. HOLDEN COMPANY

DETROIT 27, MICH. • 14341 Schaefer Highway
LOS ANGELES 58, CALIF. • 4700 East 48th Street
NEW HAVEN 8, CONN. • 460 Grand Avenue